Fastwel

epic™

CPC800-02

EPIC
Intel Pentium M Based
Processor Module

User Manual

Rev. 0.02 E

June 2008

The product described in this manual is compliant to all related CE standards.

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Fastwel welcomes suggestions, remarks and proposals regarding the form and the content of this Manual.

Notation Conventions

Warning, ESD Sensitive Device!

This symbol draws your attention to the information related to electro static sensitivity of your product and its components. To keep product safety and operability it is necessary to handle it with care and follow the ESD safety directions.

Warning!

This sign marks warnings about hot surfaces. The surface of the heatsink and some components can get very hot during operation. Take due care when handling, avoid touching hot surfaces!

Caution: Electric Shock!

This symbol warns about danger of electrical shock (> 60 V) when touching products or parts of them. Failure to observe the indicated precautions and directions may expose your life to danger and may lead to damage to your product.

Warning!

Information marked by this symbol is essential for human and equipment safety.
Read this information attentively, be watchful.

Note...

This symbol and title marks important information to be read attentively for your own benefit.

General Safety Precautions

This product was developed for fault-free operation. Its design provides conformance to all related safety requirements. However, the life of this product can be seriously shortened by improper handling and incorrect operation. That is why it is necessary to follow general safety and operational instructions below.

Warning!

Only sufficiently skilled personnel must handle this product.

Warning!

When handling this product, special care must be taken not to hit the heatsink (if installed) against another rigid object. Also, be careful not to drop the product, since this may cause damage to the heatsink, CPU or other sensitive components as well.

Please, keep in mind that any physical damage to this product is not covered under warranty.

Note:

This product is guaranteed to operate within the published temperature ranges and relevant conditions. However, prolonged operation near the maximum temperature is not recommended by Fastwel or by electronic chip manufacturers due to thermal stress related failure mechanisms. These mechanisms are common to all silicon devices, they can reduce the MTBF of the product by increasing the failure probability. Prolonged operation at the lower limits of the temperature ranges has no limitations.

Caution, Electric Shock!

Before installing this product into a system and before installing other devices on it, always ensure that your mains power is switched off.

Always disconnect external power supply cables during all handling and maintenance operations with this module to avoid serious danger of electrical shock.

Unpacking, Inspection and Handling

Please read the manual carefully before unpacking the module or mounting the device into your system. Keep in mind the following:

ESD Sensitive Device!

Electronic modules and their components are sensitive to static electricity. Even a non-perceptible by human being static discharge can be sufficient to destroy or degrade a component's operation! Therefore, all handling operations and inspections of this product must be performed with due care, in order to keep product integrity and operability:

- Preferably, unpack or pack this product only at EOS/ESD safe workplaces. Otherwise, it is important to be electrically discharged before touching the product. This can be done by touching a metal part of your system case with your hand or tool. It is particularly important to observe anti-static precautions when setting jumpers or replacing components.
- If the product contains batteries for RTC or memory back-up, ensure that the module is not placed on conductive surfaces, including anti-static mats or sponges. This can cause short-circuit and result in damage to the battery and other components.
- Store this product in its protective packaging while it is not used for operational purposes.

Unpacking

The product is carefully packed in an antistatic bag and in a carton box to protect it against possible damage and harmful influence during shipping. Unpack the product indoors only at a temperature not less than +15°C and relative humidity not more than 70%. Please note, that if the product was exposed to the temperatures below 0°C for a long time, it is necessary to keep it at normal conditions for at least 24 hours before unpacking. Do not keep the product close to a heat source.

Following ESD precautions, carefully take the product out of the shipping carton box. Proper handling of the product is critical to ensure correct operation and long-term reliability. When unpacking the product, and whenever handling it thereafter, be sure to hold the module preferably by the front panel, card edges or ejector handles. Avoid touching the components and connectors.

Retain all original packaging at least until the warranty period is over. You may need it for shipments or for storage of the product.

Initial Inspection

Although the product is carefully packaged, it is still possible that shipping damages may occur. Careful inspection of the shipping carton can reveal evidence of damage or rough handling. Should you notice that the package is damaged, please notify the shipping service and the manufacturer as soon as possible. Retain the damaged packing material for inspection.

After unpacking the product, you should inspect it for visible damage that could have occurred during shipping or unpacking. If damage is observed (usually in the form of bent component leads or loose socketed components), contact Fastwel's official distributor from which you have purchased the product for additional instructions. Depending on the severity of the damage, the product may even need to be returned to the factory for repair. DO NOT apply power to the product if it has visible damage. Doing so may cause further, possibly irreparable damage, as well as result in a fire or electric shock hazard.

If the product contains socketed components, they should be inspected to make sure they are seated fully in their sockets.

Handling

In performing all necessary installation and application operations, please follow only the instructions supplied by the present manual.

In order to keep Fastwel's warranty, you must not change or modify this product in any way, other than specifically approved by Fastwel or described in this manual.

Technical characteristics of the systems in which this product is installed, such as operating temperature ranges and power supply parameters, should conform to the requirements stated by this document.

Retain all the original packaging, you will need it to pack the product for shipping in warranty cases or for safe storage. Please, pack the product for transportation in the way it was packed by the supplier.

When handling the product, please, remember that the module, its components and connectors require delicate care. Always keep in mind the ESD sensitivity of the product.

Three Year Warranty

Fastwel Co. Ltd. (Fastwel), warrants that its standard hardware products will be free from defects in materials and workmanship under normal use and service for the currently established warranty period. Fastwel's only responsibility under this warranty is, at its option, to replace or repair any defective component part of such products free of charge.

Fastwel neither assumes nor authorizes any other liability in connection with the sale, installation or use of its products. Fastwel shall have no liability for direct or consequential damages of any kind arising out of sale, delay in delivery, installation, or use of its products.

If a product should fail through Fastwel's fault during the warranty period, it will be repaired free of charge. For out of warranty repairs, the customer will be invoiced for repair charges at current standard labor and materials rates.

Warranty period for Fastwel products is 36 months since the date of purchase.

The warranty set forth above does not extend to and shall not apply to:

1. Products, including software, which have been repaired or altered by other than Fastwel personnel, unless Buyer has properly altered or repaired the products in accordance with procedures previously approved in writing by Fastwel.
2. Products, which have been subject to power, supply reversal, misuse, neglect, accident, or improper installation.

Returning a product for repair

1. Apply to Fastwel company or to any of the Fastwel's official representatives for the Product Return Authorization.
2. Attach a failure inspection report with a product to be returned in the form, accepted by customer, with a description of the failure circumstances and symptoms.
3. Carefully package the product in the antistatic bag, in which the product had been supplied. Failure to package in antistatic material will VOID all warranties. Then package the product in a safe container for shipping.
4. The customer pays for shipping the product to Fastwel or to an official Fastwel representative or dealer.

1 Introduction

1.1 Overview

The product described in this Manual is a processor module CPC800-02, which conforms to EPIC™ (Embedded Platform for Industrial Computing™) specification. This specification has been developed by the group of industry-leading companies, such as Octagon Systems, Micro/sys, VersaLogic, WinSystems, and Ampro Computers. The modules of this format take an intermediate position between PC/104 and EBX boards in terms of size, thus filling the gap between these formats.

The EPIC system expansion capabilities are based on popular industry standards, PC/104™ and PC/104-Plus™. PC/104 self-stackable compact 3.6" x 3.8" modules deliver expansion capability via 16-bit ISA bus, and PC/104-Plus adds the power of a 32-bit PCI bus to PC/104 without changes to the form-factor. PC/104 and PC/104-Plus connectors are described in details in the appropriate sections of Chapter 2 of this Manual.

CPC800-02 is designed to be used in applications requiring reliable embedded computers combining small size and high processing power. They are applications involving data acquisition and processing, video processing, telecommunications, networking, motion control plus the associated field wiring termination, I/O circuit protection, etc. Possible applications of the technology are: communication devices, test equipment, medical instruments, transportation control systems, military/COTS, data recorders, security and access control systems, robotics, semiconductor manufacturing instruments, and industrial control systems.

CPC800-02 is a powerful yet compact single board computer based on Intel Pentium M processor in μFCBGA479 package operating at the processor speed of up to 2 GHz and a Processor Side Bus (PSB) running at 400 MHz. The Intel Pentium M processor core with integrated 64 KB L1 and up to 2048 KB L2 cache provides its unique performance to power consumption ratio. CPC800-02 utilizes the chipset which includes Intel 82855GME GMCH and 6300ESB (Hance Rapid) ICH.

The board includes up to 1 GB of soldered Double Data Rate (DDR) memory with ECC operated at 333 MHz.

System features include two Gigabit Ethernet ports and a built-in Intel 2D/3D graphics accelerator with up to 64 MB memory shared with system for enhanced graphics performance via VGA or TFT LVDS interfaces.

CPC800-02 comes with the following PC interfaces: four USB 2.0 ports, four COM ports, two EIDE ATA100 channels, one CompactFlash Type I/II socket, PS/2 interface, and one multi-mode parallel port. Audio interface available via three audio jacks and three additional CRIMP connectors.

All key components are soldered on-board providing high shock and vibration resistance. Designed for stability, the module fits into applications in industrial environments making it a perfect basic technology for long life applications. CPC800-02 employs the thoroughly selected components for embedded industrial systems to ensure their long term availability.

The board is compatible with Fastwel DOS, Microsoft® Windows® 2000/XP/XP Embedded, and Linux® operating systems.

Some of the CPC800-02's outstanding features are:

- Intel® Pentium® M processor family, up to 2.0 GHz
  - Up to 2 MB L2 on-die cache running at CPU speed
  - 400 MHz processor system bus
- 82855GME GMCH and 6300ESB (Hance Rapid) ICH chipset
- Up to 1 GB of soldered PC2700 DDR SDRAM memory with ECC
- PC/104: 16-bit ISA bus, 8.33 MHz
- PC/104-Plus: 32-bit PCI bus, 33 MHz
- Integrated high performance VGA controller
  - 2D/3D accelerator
  - Video memory up to 64 MB shared with system
  - Analog display support with resolutions of up to 2048×1536 pixels at 16 bits and 75 Hz
  - Dual LVDS interface support, resolutions up to UXGA (1600×1200) and TFT panel backlight control
- Two Gigabit Ethernet interfaces (via PCI-X bus): 10Base-T, 100Base-TX, and 1000Base-T
- Two EIDE Ultra ATA/100 channels
- Two SerialATA channels
- Onboard CompactFlash Type I/II socket
- Four serial ports
  - High speed NS16C550 compatible
  - COM1 and COM2 – RS-232
  - COM3 and COM4 – RS-485 (TTL)
- Four USB 2.0 ports
- Audio: AC97 codec LM4550
  - Line In stereo
  - Line Out stereo
  - Microphone input
  - Two additional CRIMP connectors with counterpart fixation. One of them is audio output, another serves as audio input or microphone input
- Parallel port: SPP/ECP/EPP compatible
- PS/2 keyboard and mouse interface
- Hardware monitor: voltages and temperature monitoring, system control functions (LM87)
- Programmable watchdog timer
- Additional counters and timers integrated in the ICH
- Real-time clock with Li battery
- One 1 MB on-board FWH for BIOS storage
- LPC interface
- ATX power control support
- Passive or active heatsinks solution
- Phoenix® BIOS

1.2 CPC800-02 Versions

At the present time, the module is offered in flexible configuration. The options include different processors, the size of soldered system memory, and other options described in this section. All variants are available in two versions, for industrial (-40°C to +85°C) and for commercial (0°C to 70°C) temperature ranges. Other configuration options are available upon request.

The customer can choose necessary configuration options using the following template:

1	–	2	–	3	–	4	5

1 Basic product name:
CPC800-02

2 Processor:

C1.0	Celeron M 1.0 GHz, ULV, 400 MHz FSB
P1.1	Pentium M 1.1 GHz, LV, 400 MHz FSB
P1.4	Pentium M 1.4 GHz, LV, 400 MHz FSB
P1.8	Pentium M 1.8 GHz, 400 MHz FSB

3 Soldered system memory:

RAM512	512 MB soldered DDR SDRAM
RAM1024	1024 MB soldered DDR SDRAM

4 Operating temperature range:

I	Industrial, -40°C to +85°C
C	Commercial, 0°C to +70°C

5 Other options:

CompactFlash card options (\CF####)

Volume	Industrial	Commercial
128 MB	\CF128	–
256 MB	\CF256	\CF256C
512 MB	\CF512	\CF512C
1 GB	\CF1024	\CF1024C
2 GB	\CF2G	\CF2GC
4 GB	\CF4G	\CF4GC
8 GB	–	\CF8GC
16 GB	–	\CF16GC

Coating

\COATED	Protective Coating

Operating system

\FDOS	Fastwel DOS
\2000	Windows 2000
\XP	Windows XP
\XPE	Windows XP Embedded
\LNX	Linux 2.4.20, 2.6.11

Example:

CPC800-02 – P1.8 – RAM512 – C \CF1024C \COATED \XPE

EPIC Pentium M SBC, FFD 32 MB, SVGA, LVDS, 2x Gigabit Ethernet
Pentium M 1.8 GHz, 400 MHz FSB
512 MB soldered DDR SDRAM
Commercial operating temperature range, 0°C to +70°C
1 GB CompactFlash card for commercial temperature range
Protective coating
Windows XP Embedded

1.3 Delivery Checklist

The CPC800-02 supplied set includes:

1. CPC800-02 processor module
2. 44-thread ribbon cable for 2.5" HDD connection
3. Header adapter from 44-contact 2 mm pitch to 40-contact 2.54 mm pitch (*)
4. One SATA angle data cable
5. One SATA power cable
6. CPC800-02 module mounting kit:
   - Eight hexagon stud spacers 15 mm
   - Eight screws, M3x8 (**)
   - Eight hexagon nuts, M3 (**)
   - Eight serrated lock washers, M3 (**)
   - Eight washers, M3 (**)
7. PCI intermediate connector
8. ISA intermediate connector
9. RS232/RS485 adapter cable
10. PS/2 keyboard/mouse Y-cable
11. ATX 20 to 10 power cable
12. PS/2 adapter cable
13. LVDS mating connector for FPC cable or discrete connectors
14. CF card with operating system (*)
15. CD-ROM with documentation and service software
16. Antistatic bag
17. Consumer carton box

(*) Optional

(**) Subject to change

Note:

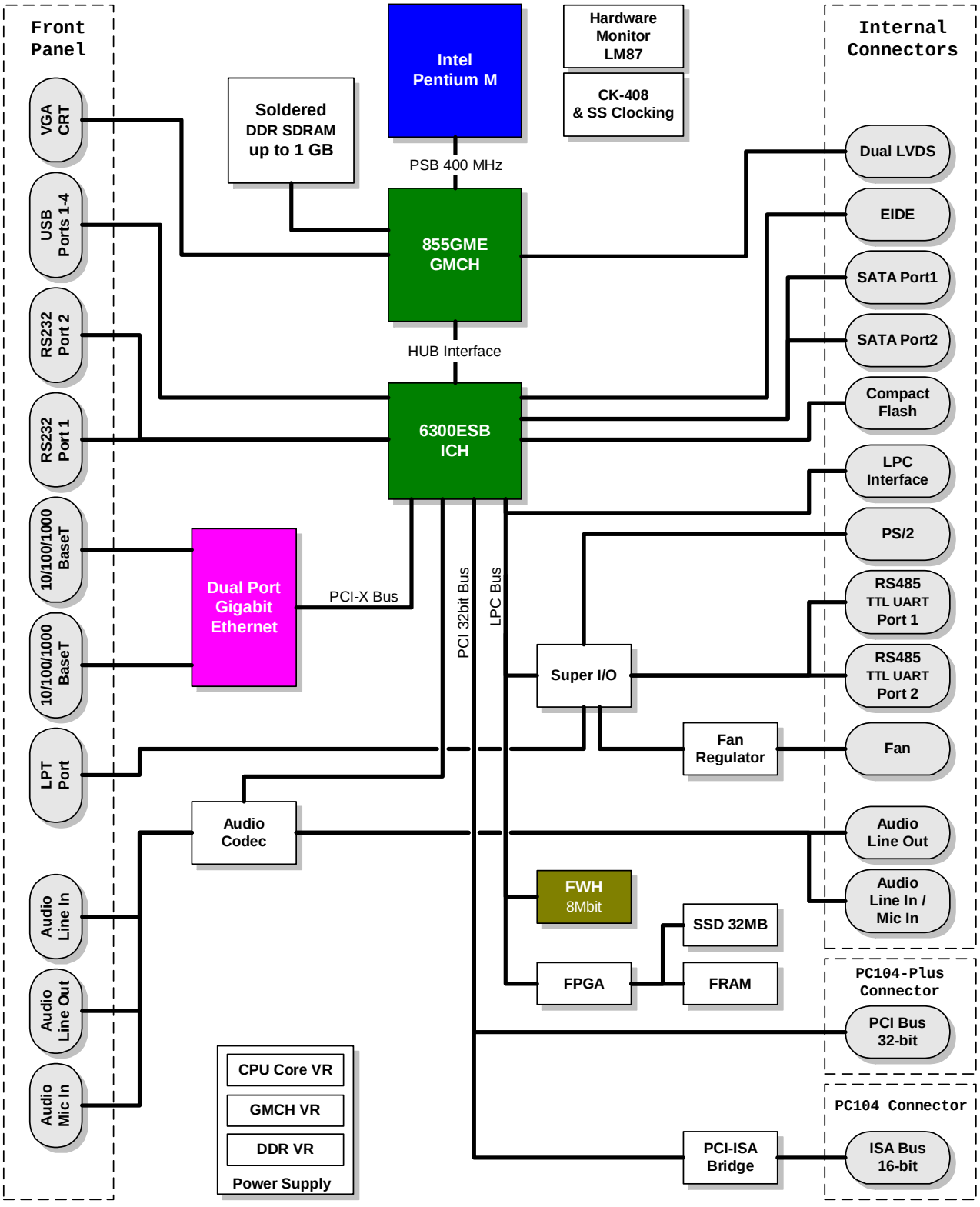
Keep the antistatic bag and the original package at least until the warranty period is over. It can be used for future storage or warranty shipments.

1.4 Module Diagrams

The diagrams in this section give visual information about the CPC800-02 module design, its appearance, connectors and components layout. The diagrams may not reflect insignificant differences between the CPC800-02 versions.

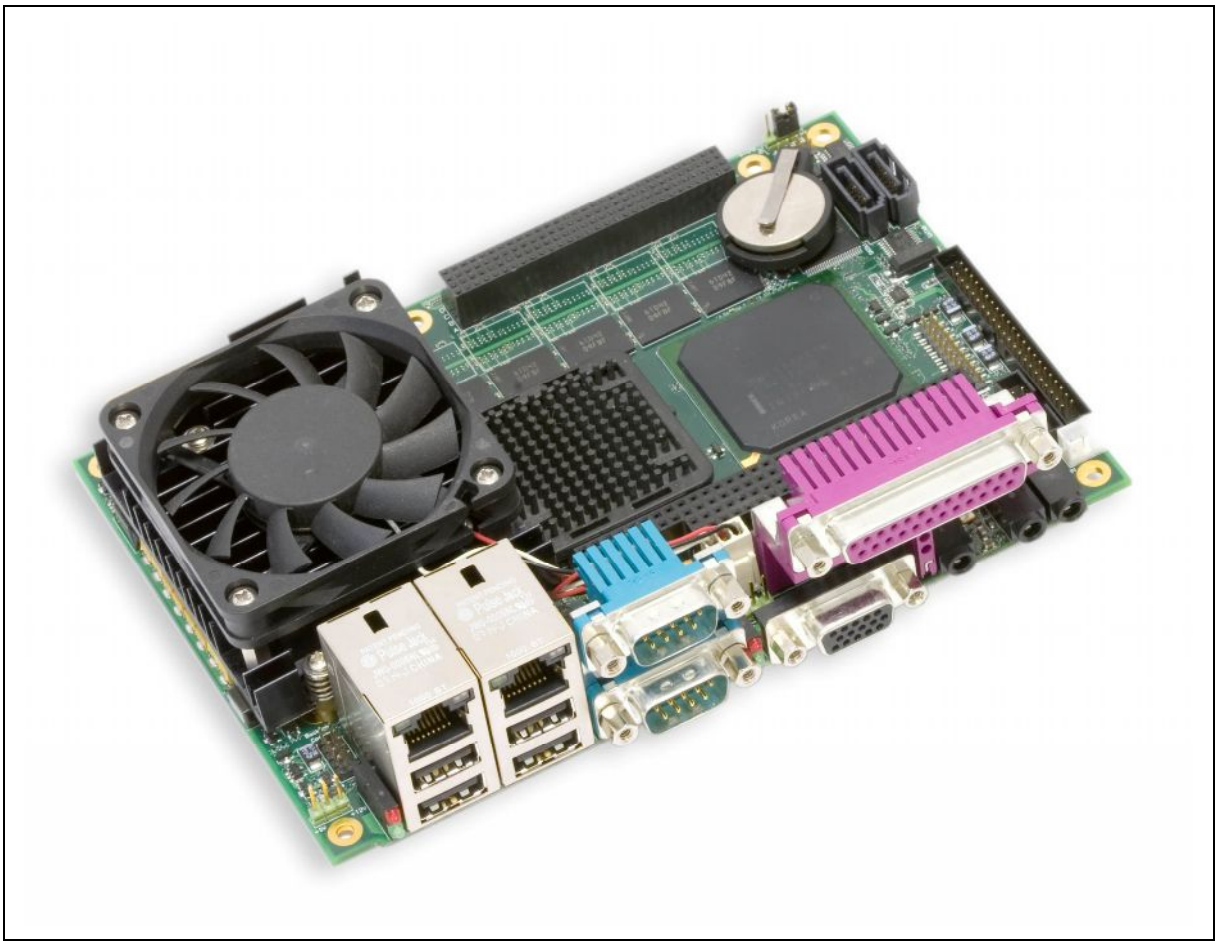
1.4.1 Block Diagram

Figure 1-1: CPC800-02 Block Diagram



1.4.2 Module Appearance

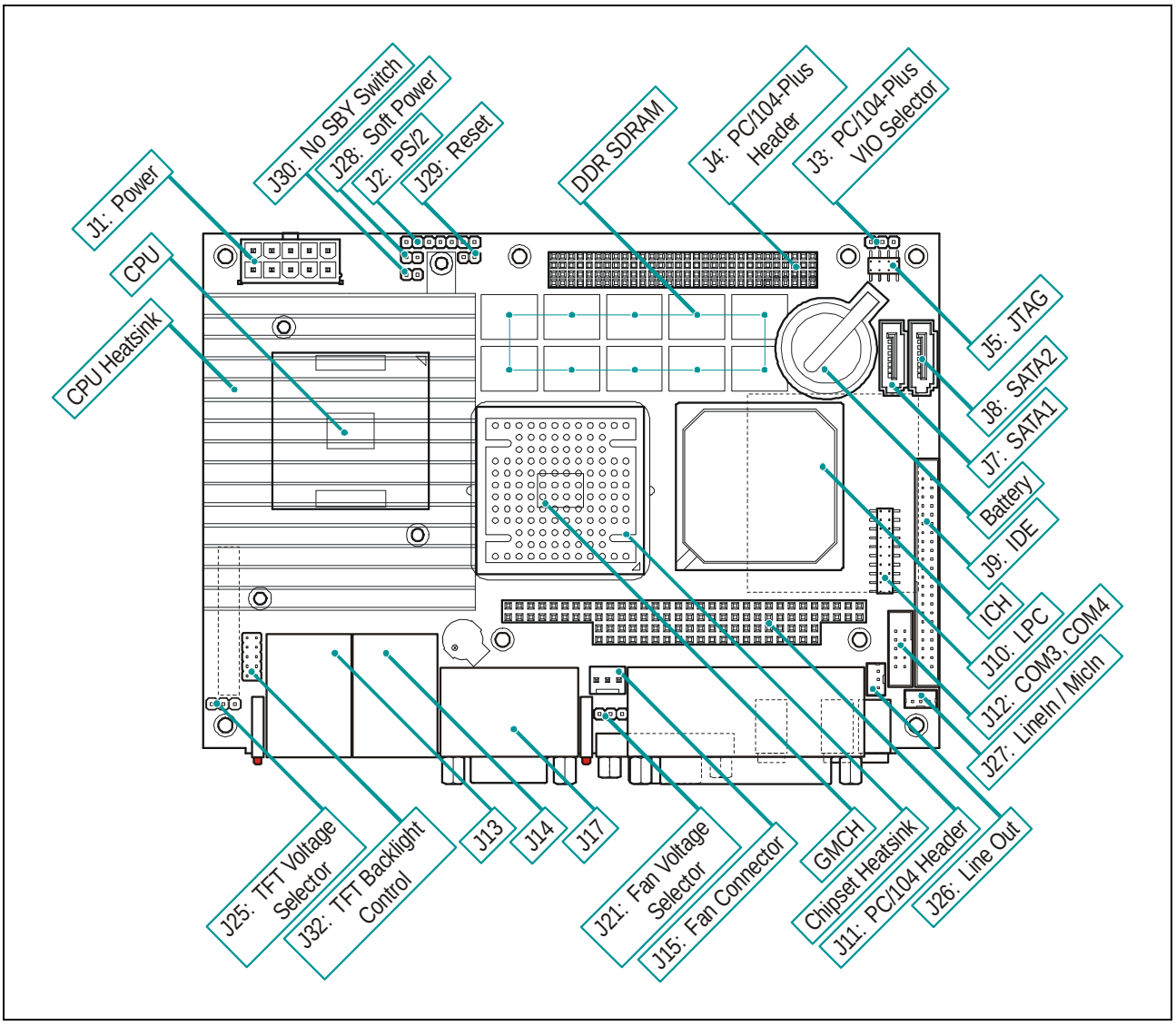
Figure 1-2: CPC800-02 Module Appearance



The appearance may vary for different versions of the module due to continuous improvement and development efforts.

1.4.3 Module Layout

Figure 1-3: CPC800-02 Module Layout (top view)

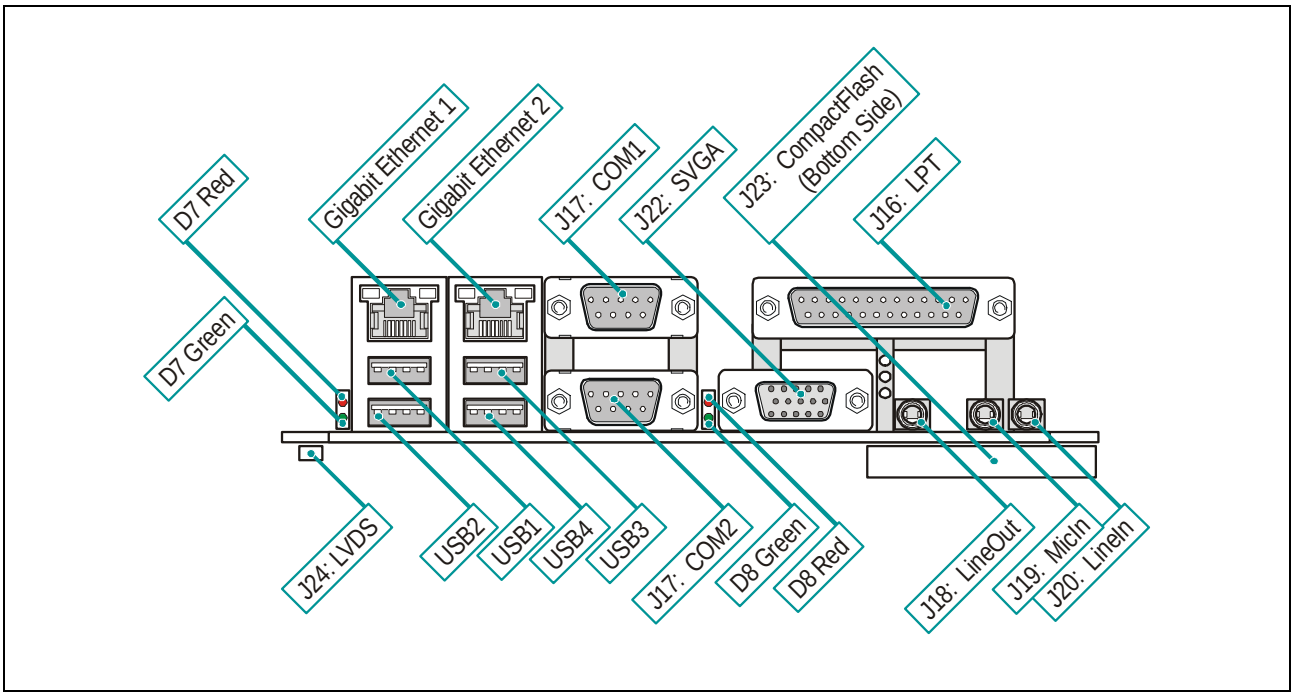


The layout may slightly vary for different versions of the module.

Processor cooling fan is not shown.

1.4.4 Front Side Connectors

Figure 1-4: CPC800-02 Front Side View (Connectors)

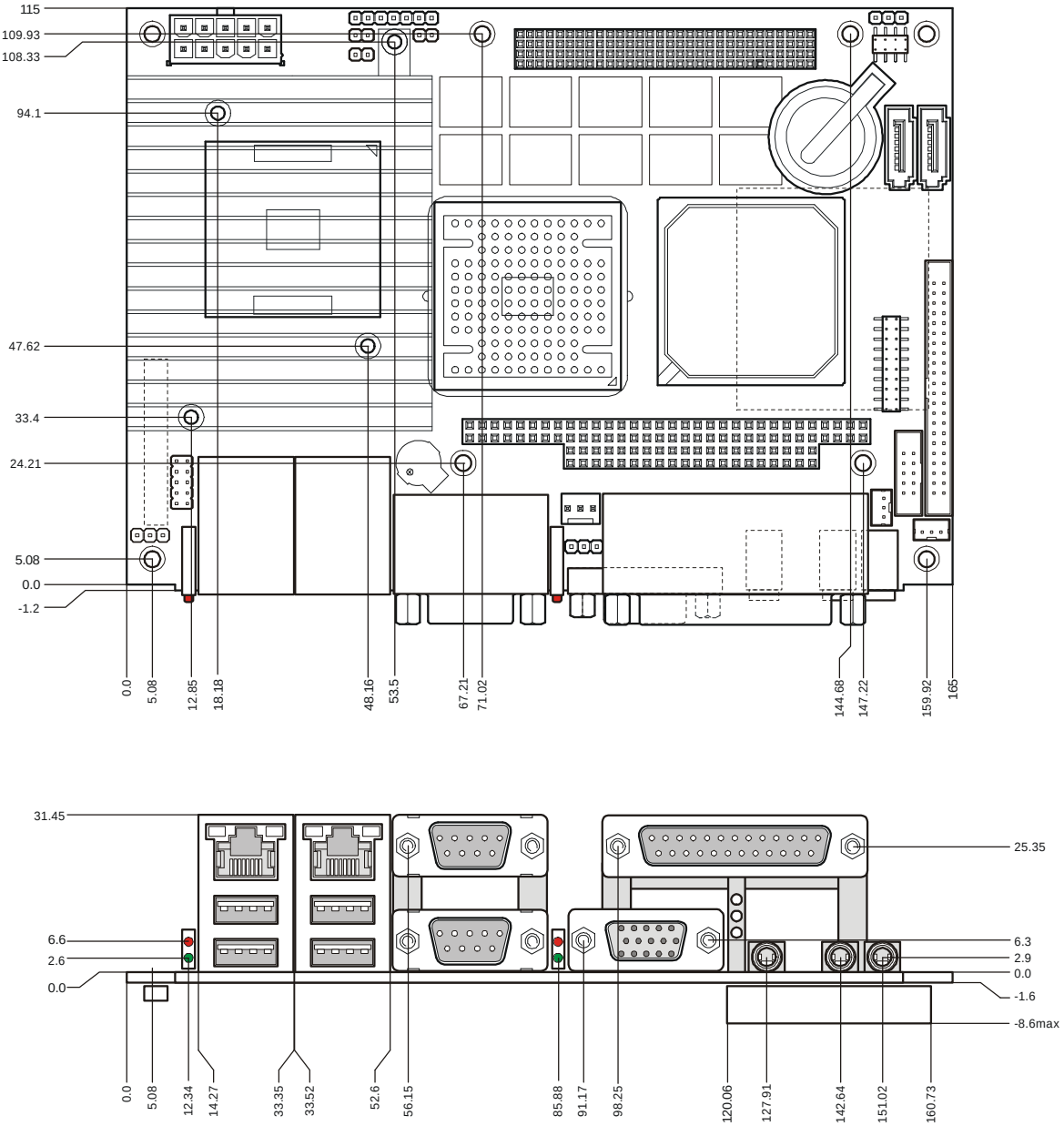


The layout may slightly vary for different versions of the module.

This view shows only the front side items, LVDS, and CompactFlash connectors location.

1.4.5 Dimensions Diagram

Figure 1-5: CPC800-02 Mounting Dimensions Diagram



1.5 Technical Specifications

1.5.1 Processor, Memory and Chipset

CPU

CPC800-02 supports one or the other of the following Intel® processor types:

Pentium® M

- Up to 2.0 GHz
- Up to 2 MB L2 on-die cache
- 400 MHz PSB
- Supports SpeedStep® III for low power mode

Low Voltage Pentium® M

- Up to 1.4 GHz
- Up to 2 MB L2 on-die cache
- 400 MHz PSB
- Supports SpeedStep® III for low power mode

Ultra Low Voltage Celeron® M

- Up to 1.0 GHz
- Up to 512 KB L2 on-die cache
- 400 MHz PSB

Memory

Main system memory:

- Up to 1 GB of soldered DDR SDRAM memory, ECC support
- Memory frequency: 333 MHz (PC2700)

Flash memory:

- 1 MB flash memory Firmware Hub (a part of the chipset)
- One 256 byte EEPROM for storing CMOS data when operating without battery
- 32 MB solid-state disk (NAND flash memory) with Fastwel file system
- 30 KB FRAM memory for vital user data emergency storing

Chipset

Intel® 82855GME Graphics and Memory Controller Hub (GMCH)

- Support for a single Pentium M family microprocessor
- 64-bit AGTL/AGTL+ based PSB interface at 400 MHz
- 64-bit System Memory interface, optimized for DDR SDRAM memory operating at 333 MHz with additional 8-bits for ECC
- Integrated 2D/3D Graphics and H/W Motion Compensation Engines
- Integrated DAC, 350 MHz

Intel® 6300ESB I/O Controller Hub (Hance Rapid ICH)

- PCI Rev. 2.2 compliant with support for 33 MHz/32-bit PCI bus
- Enhanced DMA controller, interrupt controller, and timer
- Integrated IDE controller Ultra ATA100
- USB 2.0 host interface
- PCI-X 64-bit interface
- Serial ATA controller
- AC'97 audio interface
- System Management Bus
- Power management logic support
- Low Pin Count (LPC) interface
- Firmware Hub (FWH) interface support
- Additional timers

1.5.2 Interfaces

PC/104 Interface

- 16-bit, 8.33 MHz ISA bus

PC/104-Plus Interface

- 32-bit, 33 MHz PCI bus
- 3.3V / 5.0V compatible
- PCI bus mastering devices are supported

Serial ports

- COM1 and COM2: RS-232, two 9-pin D-sub front side connectors; limited functionality (see subsection 2.3.4 for details)
- COM3 and COM4: RS-485 or TTL level UART interface; one 10-pin IDC onboard connector; 16C550 compatible UART

USB Interface

- Four USB 2.0 Type A front side sockets
- Support for UHCI and EHCI

Parallel port

Multi-Mode™ Parallel Port

- Standard Mode IBM PC/XT, PC/AT, and PS/2 compatible bidirectional parallel port
- SPP/ECP/EPP compatible

Gigabit Ethernet

Two 10/100/1000 MB/s Gigabit Ethernet interfaces based on Intel 82546GB dual port Ethernet PCI-X bus controller

- Two RJ45 front side connectors
- Automatic mode recognition
- Automatic cabling configuration recognition

Cabling requirement: Category 5, UTP, four-pair cabling

VGA CRT Interface

Built-in Intel 2D/3D Graphics accelerator for enhanced graphics performance.

- Supports analog display resolutions of up to 2048 x 1536, 16 bit at 75 Hz
- HW motion compensation for software MPEG2 and MPEG4 decoding
- Video memory up to 64 MB shared with system
- 15-pin D-sub VGA CRT-display front side connector with analog video signals

LVDS Interface

Built-in LVDS interface conforms to ANSI/TIA/EIA-644-1995 specification.

- Frequency range 35-112 MHz (single or double-channel mode)
- Dual LVDS mode support, resolutions of up to 1600 x 1200 (UXGA), up to 24 bit per pixel
- 30-contact Dual LVDS interface connector
- 10-pin IDC2-10 connector for TFT panels backlight control

Keyboard and Mouse

Super I/O support for a PS/2 keyboard and a mouse:

- Available via 7-pin 1-row on-board connector
- Mouse and keyboard simultaneous connection is possible via Y-cable

Audio Interface

The built-in AC'97 2.3 compatible controller provides audio interface via three front side connectors

- AC'97 2.3 compatible controller
- Three standard 3.5 mm coaxial front side connectors
- Two additional 3-pin latched connectors on board, one for audio output, another for line input or microphone input

LPC Interface

- Used for BIOS initial programming at the factory
- Available via 20-pin 2-row 2 mm on-board header

Mass Storage

EIDE Ultra ATA/33

- Two channels. One channel is used by CompactFlash interface
- Up to two devices (hard disks or CD-ROMs)
- Standard 44-pin, 2 mm on-board connector for 2.5" HDD connection

Serial ATA interface:

- Two standard SATA on-board connectors

Fastwel Flash Disk® (FFD)

- 32 MB NAND Flash disk (up to 1 GB as an option)

CompactFlash:

- CompactFlash Type I/II socket (true IDE mode) located on the bottom side of the module
- CompactFlash 4.1 specification supported

1.5.3 Monitoring and Control

Thermal Management

CPU overtemperature protection is provided by:

- Internal processor temperature control unit initiates CPU shut down
- Processor frequency and cooling fan control conforms to ACPI specification
- Processor die temperature monitor can report processor temperature to the user program
- Custom designed heatsinks

Temperature Monitor

- LM87 hardware monitor for supervision of the on-die CPU temperature and the board surface temperature
- Additional supervision of onboard power supplies

ATX Power Supply Control

Controlled ATX power supplies are supported

- Power supply type selection (with or without control functions)
- 2-contact connector for power supply control button

TFT Backlight and Power Control

- TFT backlight control is realized via on-board 10-contact connector
- TFT power voltage selector

Remote Reset Input

- 2-contact connector on board for connection of a remote Reset button

Watchdog Timers

- FPGA based programmable watchdog timer
- Programmable watchdog timer integrated in 6300ESB ICH

LEDs

Four LEDs are located on the front side of the module:

- D7 GP Green LED: Super I/O controlled
- D7 GP Red LED: FPGA Xilinx controlled
- D8 GP Green LED: Super I/O controlled
- D8 GP Red LED: IDE activity indicator

Gigabit Ethernet status (1 and 2):

- Line: yellow: Line connected
- Act: green: Network activity

1.5.4 Other

Mechanical

EPIC form factor

Dimensions: 165 mm × 115 mm (6.5" × 4.53", board size)
165 × 123.11 × 40.05 mm (6.5" × 4.85" × 1.58", max with connectors), see Dimensions Diagram

Module Weight: 365 g

Minimal Power Supply Requirements

- +3.3V ±5% (2A) and 5V ±5% (7A) for the onboard circuitry
- 5V ±5% (1A) for standby mode
- +12V (0.12A) for onboard cooler or LVDS monitor
- -12V supplied to PC/104 connector from the power connector; not used by CPC800-02

Temperature Ranges

Operational:	CPC800-02 -I	-40°C ... +85°C
	CPC800-02 -C	0°C ... +70°C
Storage:		-55°C ... +95°C

Humidity

RH 5% to 95%, non-condensing

Battery

3.0 V lithium battery for RTC in a battery holder; use PANASONIC BR2032 or compatible

1.5.5 Software

Software BIOS

Enhanced Phoenix® BIOS with 1 MB of Flash memory having the following features:

- Reserved CMOS memory
- LAN, USB, Multi boot and Quick boot support
- ACPI 3.0
- Crash safe and CMOS fast recovery subsystems
- BIOS boot support for USB keyboards
- Software enable/disable function for the Ethernet and COM port configuration
- Plug&Play capability

Operating Systems

Supported operating systems:

- Fastwel DOS
- Microsoft® Windows® 2000/XP/XPE
- Linux® 2.4.20, 2.6.11

To get additional information on other operating systems support, please, apply to Fastwel company.

2 Functional Description

2.1 Processor, Memory and Chipset

2.1.1 Processor

The CPC800-02 module is based on Intel® Pentium® M processor in μFCBGA479 package operating at frequencies of up to 2.0 GHz.

Intel® Pentium® M processor combines high performance and low power consumption. Its enhanced performance characteristics are provided by a newly designed processor core with an integrated 64 KB L1 and 2048 KB L2 cache.

Intel® Pentium® M processor supports Intel SpeedStep® enhanced technology to control power consumption and processor die temperature by switching the processor core voltage and frequency between several modes without resetting the system.

Important performance features of the Pentium M processor also include Intel Architecture with Dynamic Execution, Data Prefetch Logic, Advanced Transfer Cache Architecture, and 144 new Streaming SIMD instruction extensions.

2.1.2 Memory

Total capacity of the soldered DDR SDRAM chips can be up to 1 GB. The installed memory is DDR266 or DDR333 specifications compliant with ECC.

2.1.3 CPC800-02 Chipset

The Intel® 855GME chipset consists of the following devices:

- 82855GME Graphics and Memory Controller Hub (GMCH) with Accelerated Hub Architecture (AHA) bus
- 6300ESB (Hance Rapid) ICH (I/O Controller Hub) with AHA bus
- One Firmware Hub (FWH) SST49LF008

The GMCH provides interface for the microprocessor, the memory bus, the AGP 4x bus in the case of an external graphics controller, and includes a high performance graphics accelerator. The ICH is a centralized controller for I/O peripherals of the board, such as the PCI, PCI-X, USB 2.0, EIDE, SATA and AUDIO ports. Firmware Hub (FWH) has capacity of 1 MB and is used as non-volatile storage for BIOS.

North Bridge

82855GME Graphics and Memory Controller Hub (GMCH) provides interfaces with the central processor, with DDR SDRAM system memory, and interface to high performance internal graphics or AGP interface for an external VGA controller. It also provides a hub link interface to the ICH.

855GME is optimized for the Intel® Pentium® M family of microprocessors. The chipset supports a PSB frequency of 400 MHz with AGTL+ signaling. For single processor systems the single ended AGTL termination is supported. It supports 32-bit addressing for using up to 4 GB memory address space. 82855GME includes a system memory controller with a 64-bit interface with ECC. The chipset supports up to PC2700 DDR SDRAMs for use as system memory.

When running in internal graphics mode, high performance video capabilities of the 82855GME are supported by a 2D/3D graphics accelerator and H/W Motion Compensation engines for software MPEG2 decoding. The internal graphics controller allows connection of a standard CRT display and LVDS TFT panels.

South Bridge

The 6300ESB is a multifunctional I/O Controller Hub that provides interface to the PCI Bus and such PC interfaces, as UltraDMA 100/66/33 (only ATA/33 is available at the current version of the processor module), COM ports, USB 2.0 host interface, LPC interface, FWH Flash BIOS interface, SATA, PCI-X and an AC'97 digital audio. The ICH communicates with the host controller directly via a dedicated hub link interface.

I/O Controller Hub features are:

- PCI 2.2 interface with eight IRQ inputs
- Bus Master EIDE controller UltraDMA 100/66/33
- SATA interface (two channels)
- COM port controller
- Two USB controllers with up to four USB 1.1 or 2.0 ports
- Hub interface with 855GME
- LPC interface
- AC'97 2.1 interface
- PCI-X interface for communication with 82546GB Gigabit Ethernet controller
- RTC controller
- Additional timer

2.2 Internal Peripherals

The following internal peripherals are available on the CPC800-02 module:

2.2.1 Flash Memory

There are four flash devices available - one is used for the BIOS storage, one is a NAND flash memory (SSD) device, one is FRAM memory unit for emergency storage of user data, and one is a CompactFlash card in the socket.

2.2.1.1 FWH Flash Memory

FWH has capacity of 1 MB and is used as non-volatile storage for BIOS copy.

2.2.1.2 Solid-State Disk (SSD)

CPC800-02 has an on-board solid-state disk (up to 32 MB of NAND flash-memory) with Fastwel file system for storing user programs and data.

2.2.1.3 CompactFlash

CPC800-02 has a standard Compact Flash type I/II socket, which can accept memory card for use as an IDE disk drive.

2.2.1.4 FRAM Emergency Storage for User Data

32 KB of fast FRAM is installed on the module, 30 KB of it can be used as an emergency storage for critical user data in case of power supply failure.

2.2.2 Timers

CPC800-02 is equipped with the following timers:

- **RTC – Real-Time Clock**

ICH contains a real-time clock. The RTC includes 256 bytes of battery-backed CMOS RAM. The RTC features include timekeeping with alarm function and 100-year calendar, as well as programmable periodic interrupt. A coin-cell battery powers the real-time clock and CMOS memory.

- **Counter/Timer**

Three 8254-type counters/timers are available on the CPC800-02.

- **Additional Timer**

ICH includes an additional programmable timer, which prevents system hang-ups during start-ups. After the first timeout period is over, it generates the SMI# signal, which starts the software hang-up recovery subroutine. If the second timeout ends, the "Reset" signal is issued to recover the system from the hardware hang-up state.

Watchdog Timer

The watchdog timer eliminates system hang-ups both during the start-up process (for example, in case of mistakes in BIOS, when the additional timer is not able to restart the system) and during normal operation. The timeout period is set in BIOS Setup program. On the expiry of the timeout period the watchdog timer issues "Reset" signal. During start-up process watchdog timer monitors BIOS code execution. If BIOS error is detected, the system is automatically reset and red D7 LED is lit indicating system failure state. The instructions on watchdog timer programming can be found in the following subsections.

2.2.3 Watchdog Timer

FPGA XILINX XC3S200 is also used to control the watchdog timer. 17 lower bits of the 24-bit WD FPGA register are used to program the watchdog timeout period. It is possible to set the timeout period from 0 to 512 seconds with increments of 30.52 μs by changing the value in this register.

By default, without prior initialization, the watchdog timeout period is set to maximum that is 512 seconds. The equation below can be used to calculate the timeout T_{WD} in μs as a function of the decimal value in the WD register (K_{WD}):

$$T_{WD}\,[\mu s] = K_{WD} * 10^6 / 2^{15}$$

For example, decimal value "1" of K_{WD} (000001h) corresponds to the timeout of 30.52 μs, and K_{WD} = 16777215 (FFFFFFh) – 512 seconds.

2.2.3.1 Access to Watchdog Registers

The unit's configuration is based on Plug-and-Play architecture. Watchdog timer registers are available via standard I/O registers (Index and Data ports) in configuration mode.

Port	Address	Operation
Config Port	302h	Write
Index Port	302h	Read/Write
Data Port	303h	Read/Write

2.2.3.2 Configuration Mode

Configuration mode is enabled by writing <46h><57h> to Config Port. Configuration mode is disabled by writing <57h><46h> to Config Port. Index and Data ports are available in configuration mode only.

2.2.3.3 Watchdog Timer Programming

The procedures of watchdog programming is described below:

- Enter configuration mode

```
MOV   DX, 302H
MOV   AL, 46H
OUT   DX, AL
MOV   AL, 57H
OUT   DX, AL
```

- Write to LDN register a logic device number (watchdog timer has logical number 1)

```
MOV   DX, 302H
MOV   AL, 7
OUT   DX, AL
MOV   DX, 303H
MOV   AL, 1
OUT   DX, AL
```

- Watchdog timer registers are available for read and write now.
  For example, to read status register 3eh and to write the value from it back:

```
MOV   DX, 302H
MOV   AL, 3EH
OUT   DX, AL
MOV   DX, 303H
IN    AL, DX
OUT   DX, AL
```

- To exit configuration mode:

```
MOV   DX, 302H
MOV   AL, 57H
OUT   DX, AL
MOV   AL, 46H
OUT   DX, AL
```

2.2.3.4 Global Configuration Registers

Index	Type	Hard Reset	Configuration Register
7h	R/W	01h	Logical Device Number

Logical Device Number register (index 7h)

Index = 7h		
Bit	**Name**	**Description**
7:1	-	Not used
0	LDN	Write/Read: Writing to this register selects logical device.

2.2.3.5 Logical Devices Configuration Registers

Index	Type	Hard Reset	Configuration Register
30h	R/W		Activate
60h	R/W		I/O port base address bits [15:8]
61h	R/W		I/O port base address bits [7:0]
70h	R/W	00h	Primary interrupt select

Activate register

Index = 30h		
Bit	**Name**	**Description**
7:1	-	Not used
0	Activate	Write/Read: 1 – Current logical device enabled 0 – Current logical device disabled

I/O port base address registers

Index = 60h		
Bit	**Name**	**Description**
7:1	-	Not used
0	I/O_Base_Adress[15:8]	Write/Read: Current logical device base address bits 15:8
Index = 61h		
Bit	**Name**	**Description**
7:1	-	Not used
0	I/O_Base_Adress[7:0]	Write/Read: Current logical device base address bits 7:0

Primary interrupt select register

Index = 70h		
Bit	**Name**	**Description**
7:4	-	Not used
3:0	Interrupt_select	Write/Read: 00h – Interrupt disabled 01h – IRQ1 02h – SMI 03h – IRQ3 04h – IRQ4 05h – IRQ5 06h – IRQ6 07h – IRQ7 08h – IRQ8 09h – IRQ9 0ah – IRQ10 0bh – IRQ11 0ch – IRQ12 0dh – IRQ13 0eh – IRQ14 0fh – IRQ15

2.2.3.6 Watchdog Timer Registers (Logical Device 1)

Index	I/O Port Address	Type	Hard Reset	Configuration Register
30h	–	R/W		Activate
38h	Base+0	R/W		Timer current value [7:0]
39h	Base+1	R/W		Timer current value [15:8]
3ah	Base+2	R/W		Timer current value [23:16]
3bh	Base+3	R/W	00h	Timer initial value [7:0]
3ch	Base+4	R/W	40h	Timer initial value [15:8]
3dh	Base+5	R/W	00h	Timer initial value [23:16]
3eh	Base+6	R/W	00h	Status register
3fh	Base+7	R/W	03h	Control register
60h	–	R/W		Base [15:8] – I/O port base address bits [15:8]
61h	–	R/W		Base [7:3] – I/O port base address bits [7:3] Base [2:0] – should be 0
70h	–	R/W	00h	Primary interrupt select

2.2.4 Local SMBus Devices

CPC800-02 incorporates a System Management Bus to access several system monitoring and control devices via a two-wire I^{2}C™ bus interface. The following table presents functions and addresses of onboard SMBus devices.

Table 2-1: SMBus Devices

№	SMB Address	Device
1	0D2H	ICS950201 system clock generator
2	0D4H	ICS91718 TFT clock generator in suspend mode
3	0A0H	SPD EEPROM module
4	9CH	LM87 temperature monitor
5	0ACH, 0AEH	2×256 Bytes user EEPROM

2.2.4.1 Temperatures Monitoring

The integrated LM87 temperature monitor measures the processor and board surface temperatures to make sure that the system is operating at a safe temperature. Also LM87 monitors power supply voltages. On request, LM87 can report the current processor and board temperatures and voltage values to the software responsible for the module operation mode.

2.2.4.2 Serial EEPROM

There is serial EEPROM installed on CPC800-02. This nonvolatile memory is used for storage of CMOS data and some of the service parameters for emergency recovery.

2.2.5 Battery

CPC800-02 utilizes a 3.0 V lithium battery for the RTC and CMOS memory backup.
Use Panasonic BR2032 or compatible.

2.3 Module Interfaces and Connectors

2.3.1 PC/104 and PC/104-Plus Interfaces

The PC/104 and PC/104-Plus connectors allow CPC800-02 to interface with expansion modules such as A/D converters, digital I/O modules, etc. A maximum of four PC/104 or PC/104-Plus expansion boards may be stacked on the CPC800-02 module to form a fully-integrated system.

PC/104 Interface

The PC/104 interface accepts an 8- or 16-bit PC/104 expansion modules. The PC/104 Bus uses a 104-pin 0.10” (2.54 mm) header located on the top of the board. This interface header will carry all of the appropriate 8 MHz ISA bus signals.

The processor module can accommodate 4 PC/104 expansion modules maximum.

The contact configuration of PC/104 header is shown in Figure 2-1. Tables 2-2 and 2-3 give the designation of this header contacts.

Figure 2-1: PC/104 J11 Connector Contacts Layout

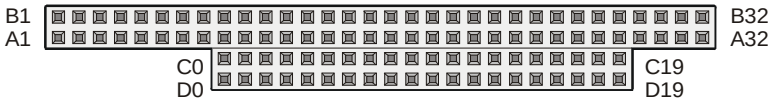


Table 2-2: PC/104 J11 (Rows A and B) Connector Contacts Designation

Pin #	Signal	In/Out	Pin #	Signal	In/Out
A1	/IOCHK	–	B1	GND	Ground
A2	SD7	In/Out	B2	RESETDRV	Out
A3	SD6	In/Out	B3	+5V	Power
A4	SD5	In/Out	B4	IRQ9	In
A5	SD4	In/Out	B5	-5V	–
A6	SD3	In/Out	B6	DRQ2	In
A7	SD2	In/Out	B7	-12V	Power
A8	SD1	In/Out	B8	/ENDXFR	In
A9	SD0	In/Out	B9	+12V	Power
A10	IOCHRDY	In	B10	KEY	–
A11	AEN	Out	B11	/SMEMW	Out
A12	SA19	Out	B12	/SMEMR	Out
A13	SA18	Out	B13	/IOW	Out
A14	SA17	Out	B14	/IOR	Out
A15	SA16	Out	B15	/DACK3	Out
A16	SA15	Out	B16	DRQ3	In
A17	SA14	Out	B17	/DACK1	Out
A18	SA13	Out	B18	DRQ1	In
A19	SA12	Out	B19	/REFRESH	Out
A20	SA11	Out	B20	SYSCLK	Out
A21	SA10	Out	B21	IRQ7	In
A22	SA9	Out	B22	IRQ6	In
A23	SA8	Out	B23	IRQ5	In
A24	SA7	Out	B24	IRQ4	In
A25	SA6	Out	B25	IRQ3	In
A26	SA5	Out	B26	/DACK2	Out
A27	SA4	Out	B27	TC	Out
A28	SA3	Out	B28	BALE	Out
A29	SA2	Out	B29	+5V	Power
A30	SA1	Out	B30	OSC	Out
A31	SA0	Out	B31	GND	Ground
A32	GND	Ground	B32	GND	Ground

Table 2-3: PC/104 J11 (Rows C and D) Connector Contacts Designation

Pin #	Signal	In/Out	Pin #	Signal	In/Out
C0	GND	Ground	D0	GND	Ground
C1	/SBHE	Out	D1	/MEMCS16	In
C2	LA23	Out	D2	/IOCS16	In
C3	LA22	Out	D3	IRQ10	In
C4	LA21	Out	D4	IRQ11	In
C5	LA20	Out	D5	IRQ12	In
C6	LA19	Out	D6	IRQ13	In
C7	LA18	Out	D7	IRQ14	In
C8	LA17	Out	D8	/DACK0	Out
C9	/MEMR	Out	D9	DRQ0	In
C10	/MEMW	Out	D10	/DACK5	Out
C11	SD8	In/Out	D11	DRQ5	In
C12	SD9	In/Out	D12	/DACK6	Out
C13	SD10	In/Out	D13	DRQ6	In
C14	SD11	In/Out	D14	/DACK7	Out
C15	SD12	In/Out	D15	DRQ7	In
C16	SD13	In/Out	D16	+5V	Power
C17	SD14	In/Out	D17	/MASTER	In
C18	SD15	In/Out	D18	GND	Ground
C19	KEY	–	D19	GND	Ground

Note:

In tables 2-2 and 2-3:

"–" - Not used;
"Power" - The power is supplied to the module installed into a crate
In/Out column shows the data transfer direction for a processor module being the bus master.

PC/104-Plus Interface

The PC/104-Plus uses a 120-pin (30x4) 2 mm header located on the top of the board. This interface header accepts 4 stackable modules and carries all of the appropriate 32-bit 33 MHz PCI signals. Three PCI bus mastering devices are supported on the PC/104-Plus header.

Figure 2-2: PC/104-Plus J4 Connector Contacts Layout

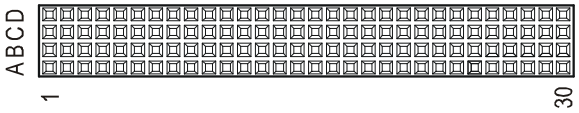
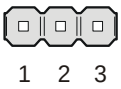


Table 2-4: PC/104-Plus J4 Connector Contacts Designation

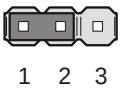
Pin	A	B	C	D
1	GND/5.0V_KEY2	Reserved	+5	AD00
2	VI/O	AD02	AD01	+5V
3	AD05	GND	AD04	AD03
4	/C/BE0	AD07	GND	AD06
5	GND	AD09	AD08	GND
6	AD11	VI/O	AD10	M66EN
7	AD14	AD13	GND	AD12
8	+3.3V	/C/BE1	AD15	+3.3V
9	/SERR	GND	Reserved	PAR
10	GND	/PERR	+3.3V	Reserved
11	/STOP	+3.3V	/LOCK	GND
12	+3.3V	/TRDY	GND	/DEVSEL
13	/FRAME	GND	/IRDY	+3.3V
14	GND	AD16	+3.3V	/C/BE2
15	AD18	+3.3V	AD17	GND
16	AD21	AD20	GND	AD19
17	+3.3V	AD23	AD22	+3.3V
18	IDSEL0	GND	IDSEL1	IDSEL2
19	AD24	/C/BE3	VI/O	IDSEL3
20	GND	AD26	AD25	GND
21	AD29	+5V	AD28	AD27
22	+5V	AD30	GND	AD31
23	/REQ0	GND	/REQ1	VI/O
24	GND	/REQ2	+5V	/GNT0
25	/GNT1	VI/O	/GNT2	GND
26	+5V	CLK0	GND	CLK1
27	CLK2	+5V	CLK3	GND
28	GND	/INTD	+5V	/RST
29	+12V	/INTA	/INTB	/INTC
30	-12V	Reserved	Reserved	GND/3.3V_KEY

The PC/104-Plus VIO selector (J3) is located on the top side of the module and allows to set the voltage supplied to PCI interface I/O buffers. It is a standard 3-pin header. Figure below presents explanation of its jumper positions.

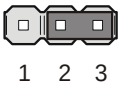
Figure 2-3: PC/104-Plus VIO Selector J3 Positions



The jumper should be removed only if the module is powered via J4 connector from a PC/104-Plus power supply module. In case the processor module receives power through J1 connector, the jumper must be installed in one of the two positions, described below.



Contacts 1-2 closed, +5 V power is supplied to PCI interface I/O buffers



Contacts 2-3 closed, +3.3 V is supplied.

2.3.2 Graphics Controller

The 855GME chipset includes a highly integrated graphics accelerator delivering high performance 2D and 3D video capabilities. The internal graphics controller provides interface to a standard analog monitor via SVGA connector on CPC800-02 front side panel and to TFT digital panels via LVDS connector on the bottom side of the board.

Integrated 2D/3D graphics features:

- Resolutions up to 1600×1200 at 100 Hz, 1920×1440 at 85 Hz and 2048×1536 at 75 Hz
- LVDS interface resolutions up to UXGA (1600×1200)
- 3D Setup and Render Engine
- 3D Graphics Rasterization Enhancements
- High Quality Texture Engine
- Full 2D hardware acceleration
- Intel® 855GM/855GME DVMT graphics core
- Intelligent Memory Management
- Integrated 350 MHz DAC

2.3.2.1 DVM Technology

The 855GME chipset supports the Dynamic Video Memory Technology (DVMT). This technology provides use of all available memory in the most efficient way for maximum graphics performance. DVMT dynamically responds to requests from applications allocating the required amount of video memory. The Intel® 855GME graphics driver is allowed to request up to 64 MB of system memory. When not needed by the graphics subsystem, the memory is freed up for other applications. Thus, memory usage is balanced for optimal graphics and system memory performance.

To support legacy VGA devices the internal video-controller needs at least 1 MB of system memory. Thus, the reported system memory size is always 1 MB less than available amount of physical memory.

2.3.2.2 Supported Resolutions

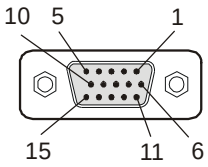
The integrated 350 MHz RAMDAC of the 855GME chipset allows direct connection of a progressive scan analog monitor with a resolution of up to 2048 × 1536 at 75 Hz. The supported resolution depends on the color depth and on the vertical scanning frequency, as illustrated in the table below.

Table 2-5: Supported Display Modes

Display Mode	Color Resolution vs. Vertical Frequency											
	8-bit Indexed				16- bit				32- bit			
	60	75	85	100	60	75	85	100	60	75	85	100
640 × 480	×	×	×	×	×	×	×	×	×	×	×	×
800 × 600	×	×	×	×	×	×	×	×	×	×	×	×
1024 × 768	×	×	×	×	×	×	×	×	×	×	×	×
1280 × 1024	×	×	×	×	×	×	×	×	×	×	×	×
1600 × 1200	×	×	×	×	×	×	×	×	×	×	×	×
1920 × 1440	×	×	×		×	×	×		×	×	×	
2048 × 1536	×	×			×	×			×	×		

2.3.2.3 VGA CRT Interface and Connector

Figure 2-4: D-Sub VGA-CRT J22 Connector



The 15-contact female D-Sub standard connector is used to connect a VGA CRT analog monitor to the CPC800-02 module. This connector is located on the front side of the module.

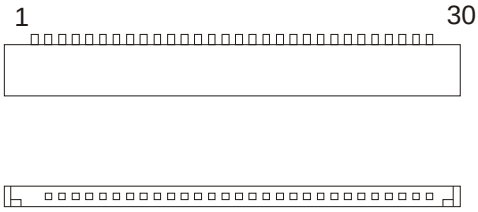
Table 2-6: SVGA J22 Front Side Connector Pinout

Pin Number	Signal	Function	In/Out
1	Red	Red video signal output	Out
2	Green	Green video signal output	Out
3	Blue	Blue video signal output	Out
9	VCC_MON	Power +5V, 200 mA	Out
12	DDC_DATA	I^2C™ data	In/Out
13	HSYNC	Horizontal sync.	TTL out
14	VSYNC	Vertical sync.	TTL out
15	DDC_CLOCK	I^2C™ clock	Out
5, 6, 7, 8	GND	Signal ground	–
4, 10, 11	NC	–	–

2.3.2.4 LVDS Interface

Dual LVDS interface is available via a 30-contact J24 connector located on bottom side of the board. A 10-pin connector J32 (IDC2-10 mating socket) is used for backlight control. Resolutions up to 1600×1200 (UXGA) are supported at 24 bpp. In Dual LVDS mode 36/48-bit color information is transformed into 6 or 8-bit per color to be transferred via LVDS channel. Operating frequency range is 35 – 112 MHz for single or dual channel mode.

Figure 2-5: J24 LVDS Connector



30-contact LVDS header is used for connection of digital TFT panels

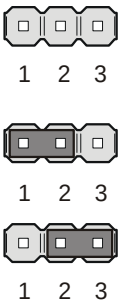
Table 2-7: J24 LVDS Connector Pinout

Contact #	Signal	Description	In/Out
27	LA_DATA_P0	Differential Signal Positive	–
28	LA_DATA_N0	Differential Signal Negative	–
25	LA_DATA_P1	Differential Signal Positive	–
26	LA_DATA_N1	Differential Signal Negative	–
23	LA_DATA_P2	Differential Signal Positive	–
24	LA_DATA_N2	Differential Signal Negative	–
19	LA_DATA_P3	Differential Signal Positive	–
20	LA_DATA_N3	Differential Signal Negative	–
21	LA_CLK_P	Differential Clock Positive	–
22	LA_CLK_N	Differential Clock Negative	–
15	LB_DATA_P0	Differential Signal Positive	–
16	LB_DATA_N0	Differential Signal Negative	–
13	LB_DATA_P1	Differential Signal Positive	–
14	LB_DATA_N1	Differential Signal Negative	–
11	LB_DATA_P2	Differential Signal Positive	–
12	LB_DATA_N2	Differential Signal Negative	–
7	LB_DATA_P3	Differential Signal Positive	–
8	LB_DATA_N3	Differential Signal Negative	–
9	LB_CLK_P	Differential Clock Positive	–
10	LB_CLK_N	Differential Clock Negative	–
1, 2, 3, 4	VDD	Panel Power 5V or 12V	–
5, 6, 17, 18, 29, 30	GND	Signal ground	–

It is recommended to use, for example, a 12-inch Sharp LQ121S1LG41 panel with Power Systems PS-DA0253-03-E-B invertor. For your convenience an LVDS mating connector is included in CPC800-02 supplied set.

TFT Panel Power Voltage Selection

Figure 2-6: J25 TFT Panel Power Voltage Selector



J25 is a standard 3-pin header used for TFT power voltage (V_{DD}) selection. It is located on the top side of the module. Figure below presents explanation of its jumper positions.

Pins 1-2 closed: +5 V power is supplied to a panel

Contacts 2-3 closed: +12 V is supplied

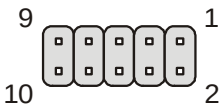
Attention!

Take due care selecting TFT panel power voltage!

Wrong setting can result in a damage to the panel. Please, apply to specifications of a panel for correct voltage level.

Digital Panel Backlight Control

Figure 2-7: J32 Panel Backlight Control Connector



A 10-pin header on top side of CPC800-02 is used for connection of an invertor via IDC2-10 mating connector. Backlight control mode is selected in BIOS setup program or by internal graphics controller driver for the installed operating system.

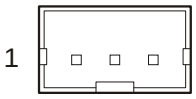
Table 2-8: J32 Backlight Control Connector Pinout

Pin #	Signal	Description	In/Out
1	+12V	+12V for voltage selector	–
2	Backlight Control Voltage Selector	Connecting this pin with pin #1 or pin #4 allows to select voltage for pin#6	–
3	GND	Signal ground	–
4	+5V	+5V for voltage selector	–
5	Backlight Enable	Backlight On/Off function, 5V-level	Out
6	Backlight Control Out	Backlight brightness control output. Voltage defined by input level on pin #2	Out
7	NC	–	–
8	NC	–	–
9	LVDS DDC CLK	DDC clock signal	Out
10	LVDS DDC DATA	DDC data signal	In/Out

2.3.3 Audio Interface

The following standard audio connectors are located on the front side panel: LineOut (J18); LineIn (J20); Microphone (J19). Additionally, two CRIMP connectors with counterpart fixation are mounted on the top side of the board: LineOut (J26), and LineIn (default) / Microphone In (J27).

Figure 2-8: Onboard CRIMP Audio Connectors: J26 and J27



Pinouts of 3-pin onboard audio connectors are presented in two tables below.

Table 2-9: J26 LineOut Connector Pinout

Pin #	Signal	Description	In/Out
1	Right	Right channel output	Out
2	Analog ground	Analog ground	–
3	Left	Left channel output	Out

Table 2-10: J27 Line Input or Microphone Input Connector Pinout

Pin #	Signal	Description	In/Out
1	Right	Right channel input / microphone bias	In/Out
2	Analog ground	Analog ground	–
3	Left	Left channel input / microphone Input	In

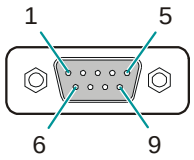
2.3.4 Serial Interfaces

COM1 and COM2 (RS-232 with limited functionality, see below) are available at the front side panel as two 9-pin D-Sub connectors (J17), and COM3 and COM4 (RS-485 or TTL) are available via one 10-pin IDC onboard header (J12). All COM ports are fully compatible with the 16550 controller and include a complete set of handshaking and modem control signals, maskable interrupt generation and data transfer of up to 460.8 Kb/s. Switching between RS-485 and TTL modes for COM3 and COM4 ports is performed in BIOS Setup.

Table 2-11: Functions of the Serial Port Interfaces

Interface	Connector Name	Location	Function
COM1	J17A	Front Side	RS232
COM2	J17B	Front Side	RS232
COM3	J12	On board	RS485/TTL
COM4		On board	RS485/TTL

Figure 2-9: D-Sub Serial Connectors J17A and J17B



The COM1 and COM2 interfaces use the 9-pin D-sub connectors on the front side.

According to "Intel 6300ESB I/O Controller HUB (ICH) Specification update", it has limited functionality due to unexpected behavior of serial port interrupt enable register.

Below is an abstract from this document:

2. Behavior of Serial Port Interrupt Enable Register

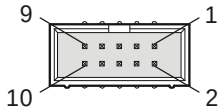
Problem:	The Serial Port Interrupt Enable Register (IER) bit 1 [3f9h] (Transmit Data request Interrupt Enable) will not change status if the bit has been set previously.
Implication:	Will not cause an interrupt if the register bit has been set already. This hinders the serial ports from being fully 100 percent 16550 compatible.
Workaround:	Customers may be able to implement a BIOS workaround to clear out the bit IER bit 1 to '0' before programing the bit to '1'.
Status:	No fix.

Thus serial ports integrated in South bridge are compatible with standard UART 16550, except the following registers:

1. Changed designation of bits 4 and 5 of IER (Interrupt Enable Register)
2. Changed designation of bits 6 and 7 of FCR (FIFO Control Register)

For details see "IntelR 6300ESB I/O Controller Hub Datasheet. February 2004", pages 667-671.

Figure 2-10: IDC10 J12 Header



The COM3 and COM4 interfaces are available via one 10-pin IDC onboard header.

Serial connectors' pinouts are presented in the tables below.

Table 2-12: Serial Port Connectors J17A (COM1) and J17B (COM2) Pinout

Pin	RS232	Pin	RS232
1	DCD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	RIN
5	GND	–	–

Table 2-13: Serial Ports Connector J12 (COM3 and COM4) Pinout

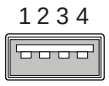
Pin	Signal	Pin	Signal
1	D1	6	D2#
2	D1#	7	RXD1
3	GND	8	TXD1
4	+5V	9	RXD2
5	D2	10	TXD2

Note:

The RS485 interfaces (COM3 and COM4) provide for support of up to 256 network segments. In case the module is supposed to serve as a terminal network device, it is necessary to mention this fact when ordering the module. The required SMT 120 ohm terminal resistors will be installed at the factory.

2.3.5 USB Interfaces

Figure 2-11: USB1 to USB4 Connectors Contacts



CPC800-02 supports four USB 2.0 ports, they are available via standard A-type USB sockets at CPC800-02 front side (J13 and J14 connector blocks). All four ports are high-speed, full-speed, and low-speed capable.

UHCI compliant Hi-speed USB 2.0 allows data transfers of up to 480 Mb/s – 40 times faster than a full-speed USB (USB 1.1).

One USB peripheral may be connected to each port. To connect more than four USB devices use an external hub. The USB power supply is protected by a self-resettable 500 mA fuse.

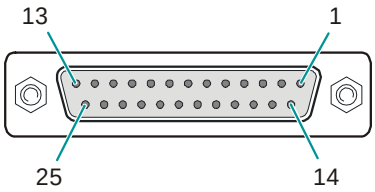
The table below presents the contacts' designation of USB connectors.

Table 2-14: USB1 to USB4 Pinouts (CPC800-02 Front Side)

Pin Number	Signal	Function	In/Out
1	VCC	VCC signal	–
2	UV0–	Differential USB–	–
3	UV0+	Differential USB+	–
4	GND	GND signal	–

2.3.6 Parallel Port Interface

Figure 2-12: D-Sub LPT Connector J16



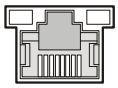
Standard parallel port (IEEE1284, ECP/EPP) is available via the front side standard 25-contact female connector.
Its contacts designation is presented below.

Table 2-15: D-Sub LPT Connector J16 Pinout

Pin #	LPT1 Signals	Pin #	LPT1 Signals
1	/STROBE	14	/AUTOFD
2	D0	15	/ERR
3	D1	16	/INIT
4	D2	17	/SELIN
5	D3	18	GND
6	D4	19	GND
7	D5	20	GND
8	D6	21	GND
9	D7	22	GND
10	/ACK	23	GND
11	BUSY	24	GND
12	PE	25	GND
13	SEL	–	–

2.3.7 Gigabit Ethernet

Figure 2-13: Gigabit Ethernet Connectors



CPC800-02 module includes two 10Base-T / 100Base-TX / 1000Base-T Ethernet ports based on the Intel® 82546GB dual-port Gigabit Ethernet PCI-X Bus Controller. Each of the two front side Ethernet connectors is realized as an RJ45 front side connector for twisted-pair cabling.

The Intel® 82546GB Gigabit Ethernet controller architecture combines high performance and low power consumption. The controller's features include independent transmit and receive queues to limit PCI-X bus traffic, and a PCI-X interface that maximizes the use of bursts for efficient bus usage.

The interfaces provide automatic detection and switching between 10Base-T, 100Base-TX and 1000Base-T operation modes. Each of the two Ethernet channels may be disabled via the BIOS Setup or user software utility to free system resources .

Table 2-16: Gigabit Ethernet Connectors Pinouts

Pin	10Base-T		100Base-TX		1000Base-T	
	I/O	Signal	I/O	Signal	I/O	Signal
1	O	TX+	O	TX+	I/O	BI_DA+
2	O	TX–	O	TX–	I/O	BI_DA–
3	I	RX+	I	RX+	I/O	BI_DB+
4	–	–	–	–	I/O	BI_DC+
5	–	–	–	–	I/O	BI_DC–
6	I	RX–	I	RX–	I/O	BI_DB–
7	–	–	–	–	I/O	BI_DD+
8	–	–	–	–	I/O	BI_DD–

MDI / Standard Ethernet Cable

Integrated Ethernet LEDs

Green: Line: This LED indicates network connection. The LED lights up when the line is connected.

Green: Act: this LED monitors network activity. The LED lights up when network packets are sent or received through the RJ45 port. When this LED is not lit, it means that the computer is not sending or receiving network data.

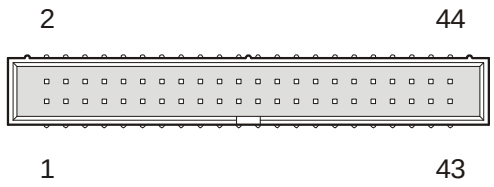
2.3.8 EIDE Interface

The EIDE interface supports several operation modes: PIO mode, 8237-type DMA mode, Ultra DMA/33 modes. In PIO mode the central processor controls the data transfers. In all the DMA modes the CPU is not engaged in data transfer. DMA modes are similar to each other, but differ in data transfer protocols details and DMA clock frequency, thus providing different transfer rates. Only ATA/33 mode is available at the current version of the processor module, providing transfer rates of up to 33.3 MB/sec.

The current version of CPC800-02 supports two EIDE channels, but only one of them is available for user devices connection. Primary channel is used by CompactFlash, secondary channel is routed via the standard AT HDD 44-pin onboard connector, which is used for connection of external EIDE devices.

The CPC800-02 CompactFlash connector is connected to the primary EIDE channel.

Figure 2-14: J9 HDD Connector



A standard AT HDD 44-pin IDC connector is mounted on the top side of the board. It is possible to connect both secondary master and secondary slave devices to this EIDE channel. Maximum IDE cable length is 50 cm. The pinout of the standard AT HDD connector is shown in the table below.

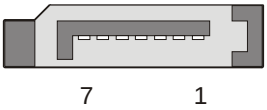
Table 2-17: Standard EIDE HDD Connector J9 Pinout

Pin Number	Signal	Function	In/Out
1	/RESET	Reset HD	Out
2	GND	Ground signal	–
3	DD7	HD data 7	In/Out
4	DD8	HD data 8	In/Out
5	DD6	HD data 6	In/Out
6	DD9	HD data 9	In/Out
7	DD5	HD data 5	In/Out
8	DD10	HD data 10	In/Out
9	DD4	HD data 4	In/Out
10	DD11	HD data 11	In/Out
11	DD3	HD data 3	In/Out
12	DD12	HD data 12	In/Out
13	DD2	HD data 2	In/Out
14	DD13	HD data 13	In/Out
15	DD1	HD data 1	In/Out
16	DD14	HD data 14	In/Out
17	DD0	HD data 0	In/Out
18	DD15	HD data 15	In/Out
19	GND	Ground signal	–
20	–	–	–
21	DRQ	DMA request	In
22	GND	Ground signal	–
23	/IOW	I/O write	Out
24	GND	Ground signal	–
25	/IOR	I/O read	Out
26	GND	Ground signal	–
27	/IOCHRDY	I/O channel ready	In
28	GND	Ground signal	–

Pin Number	Signal	Function	In/Out
29	/DACK	DMA Ack	Out
30	GND	Ground signal	–
31	IRQ	Interrupt request	In
32	/CS16	–	–
33	DA1	Address 1	Out
34	–	ATA66/100 Detect	–
35	DA0	Address 0	Out
36	DA2	Address 2	Out
37	/CS1	Select Register #1	Out
38	/CS3	Select Register #3	Out
39	DASP	IDE Activity	Out
40	GND	Ground signal	–
41	+5V	+5V	–
42	+5V	+5V	–
43	GND	Ground signal	–
44	–	–	–

2.3.9 SerialATA Interface

Figure 2-15: SATA Connector



CPC800-02 bears two on-board SATA connectors (J7, J8) for attachment of external SerialATA HDDs with the exchange rate of up to 150 MB/s.
The connectors' pinout is presented in the table below.

Table 2-18: SATA Connector (J7, J8) Pinout

Contact Number	Function
1	GND
2	TXP
3	TXN
4	GND
5	RXN
6	RXP
7	GND

It is recommended to use a 45 cm cable for connection of SATA drives.

2.3.10 CompactFlash Socket

CompactFlash card is a compact removable mass storage device. It provides full IDE functionality compatible with the 16-bit ATA/ATAPI-4 interface. CPC800-02 has a CompactFlash Type I/II 50-pin socket J23 on the bottom side of the board.

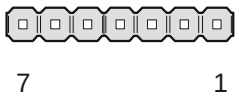
CompactFlash socket is connected to the primary master EIDE port in the current version of CPC800-02.

Table 2-19: CompactFlash Socket J23 Pinout

Pin Number	Signal	Function	In/Out
1	GND	Ground signal	–
2	D03	Data 3	In/Out
3	D04	Data 4	In/Out
4	D05	Data 5	In/Out
5	D06	Data 6	In/Out
6	D07	Data 7	In/Out
7	IDE_CS0	Chip select 0	Out
8	GND	–	–
9	GND	–	–
10	GND	–	–
11	GND	–	–
12	GND	–	–
13	3.3 V	3.3 V power	–
14	GND	–	–
15	GND	–	–
16	GND	–	–
17	GND	–	–
18	A02	Address 2	Out
19	A01	Address 1	Out
20	A00	Address 0	Out
21	D00	Data 0	In/Out
22	D01	Data 1	In/Out
23	D02	Data 2	In/Out
24	IOCS16	–	–
25	CD2	–	–
26	CD1	–	–
27	D11	Data 11	In/Out
28	D12	Data 12	In/Out
29	D13	Data 13	In/Out
30	D14	Data 14	In/Out
31	D15	Data 15	In/Out
32	IDE_CS1	Chip select 1	Out
33	VS1	–	–
34	IORD	I/O read	Out
35	IOWR	I/O write	Out
36	3.3 V	3.3 V power	–
37	INTRQ	Interrupt	In
38	3.3 V	3.3 V power	–
39	CSEL	Master/Slave	Out
40	VS2	–	–
41	Reset	Reset	Out
42	IORDY	I/O ready	In
43	INPACK	DMA Request	Out
44	REG	DMA Acknowledge	–
45	ACTIVE	IDE Activity	–
46	PDIAG	DMA Mode Detect	–
47	D08	Data 08	In/Out
48	D09	Data 09	In/Out
49	D10	Data 10	In/Out
50	GND	–	–

2.3.11 PS/2 Keyboard/Mouse Interface

Figure 2-16: PS/2 Connector J2



PS/2 port is available via a 1-row 7-contact onboard connector. Mouse and keyboard can be connected simultaneously using Y-cable (supplied with the module).

The pinout of this connector is shown in the table below.

Table 2-20: PS/2 Connector J2 Pinout

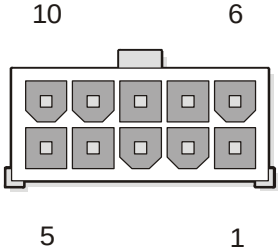
Pin Number	Signal	Pin Number	Signal
1	VCC 5 V	5	MCLK
2	KBDDAT	6	GND
3	KBDCLK	7	NC
4	MDAT	–	–

Note:

The keyboard/mouse power supply unit is protected by a 500 mA fuse. All signal lines are EMI-filtered.

2.3.12 EPIC Power Supply Connector

Figure 2-17: External Power Supply Connector J1



The standard ATX 2-row 10-pin connector for EPIC power supply is located on the top side of the module. Aternatively, power can be supplied via PC/104-Plus connector.

The 20 to 10 contact ATX power cable is supplied with the module.

The pinout of this connector is shown in the table below.

Table 2-21: EPIC Power Supply Connector J1 Pinout

Pin Number	Signal	Pin Number	Signal
1	PS_ON	6	+5VSB
2	GND	7	+5V
3	GND	8	+5V
4	+12V	9	–12V
5	+3.3V	10	GND

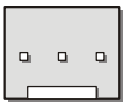
A standard 2-pin jumper switch (J30) for selection of an external power supply type is installed on the top side of the module. Figure 4-1 illustrates and explains J30 jumper positions. If an external power supply does not support control functions, contacts 1-2 should be closed. Open position of the jumper (default) corresponds to an ATX external power supply with control functions support.

Note:

If an external power supply without control functions support is used, it is allowed to leave contact 6 of J1 power connector not connected.

2.3.13 Fan Connector

Figure 2-18: Fan Connector J15



There is a standard 3-pin 2.54 mm pitch header for connection of the processor cooling fan on the top side of the board.

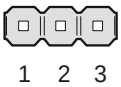
The connector's pinout is presented in the table below.

Table 2-22: J15 Fan Connector Pinout

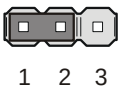
Pin Number	Function
1	FANTACH
2	FANCTL (+5 V / +12 V)
3	GND

3-pin jumper switch J21 located next to the fan connector on board allows to select the cooling fan power voltage. The options are: "+5 V", "+12 V", "Off". The three positions of a jumper are explained below.

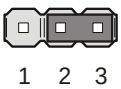
Figure 2-19: Fan Voltage Selector J21 Positions



Off



Contacts 1-2 closed,
+12 V is supplied to the pin "2" of the fan connector.



Contacts 2-3 closed,
+5 V is supplied to the pin "2" of the fan connector.

2.3.14 Soft Power and Reset Connectors

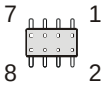
2-pin connectors SoftPower and Reset (J28 and J29) are located on the top side of the module. They are used for connection of remote buttons without closed (depressed) state latching.

A button connected to J28 pins allows to switch between several power states. Pressed once in S5 (Soft-off) mode, it switches the module into S0 (Full-on) mode. Pressed once in S0 (Full-on) mode, it switches the system into S1 or S3 standby mode depending on setup settings. Retention of this button in pressed position for more than 4 seconds in S0 (Full-on) mode switches the system into S5 (Soft-off) mode.

Depressing the button connected to J29 pins initiates system Reset and restart of the module.

2.3.15 JTAG and LPC Connectors

Figure 2-20: JTAG Header J5

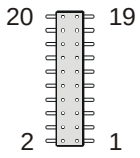


8-pin JTAG header is located on the board of CPC800-02. This header is used for the FPGA initial programming by the manufacturer. The connector's pinout is presented in the table below.

Table 2-23: JTAG J5 Connector Pinout

Pin Number	Signal	Pin Number	Signal
1	M_RESET#	5	GND
2	TDI	6	TCK
3	GND	7	VCC
4	TDO	8	TMS

Figure 2-21: LPC Header J10



20-pin LPC header is located on the top side of CPC800-02 board. This header is used for the BIOS initial programming at the factory. The connector's pinout is presented in the table below.

Table 2-24: LPC J10 Connector Pinout

Pin Number	Signal	Pin Number	Signal
1	LAD0	11	LDRQ#
2	PCIRST#	12	PME#
3	LAD1	13	LPD#
4	GND	14	GND
5	LAD2	15	+3_3V
6	PCICLK	16	FWH_INIT#
7	LAD3	17	BOOT
8	GND	18	+5V
9	LFRAME#	19	WRITE_EN
10	SERIRQ	20	GND

2.3.16 LED Indicators

There are four LED indicators on the front side of CPC800-02. Their functions are presented in the table below.

Table 2-25: Front Side LEDs

Name	Function
D7 Green	General purpose LED controlled by Super I/O
D7 Red	General purpose LED controlled by FPGA Xilinx XC3S200
D8 Green	General purpose LED controlled by Super I/O
D8 Red	IDE activity

LED's Default Functions:

D7 (red) – has no default function – programmable only.

D7 (green) – "System Boot State". D7 (green) blinks while system is starting boot sequence and lights up when the boot procedure successfully finished.

D8 (red) – "IDE Activity". D8 (red) lights up while system using IDE devices.

D8 (green) – has no default function – programmable only.

2.3.16.1 D7 Red LED Control

D7 Red LED is controlled by means of FPGA XILINX XC3S200 using bit#3 (LED) of the control register.

Programming sequence:

- Enter configuration mode:

```
MOV   DX, 302H
MOV   AL, 46H
OUT   DX, AL
MOV   AL, 57H
OUT   DX, AL
```

- Write to LDN register logical device number (number 1, the same as WD)

```
MOV   DX, 302H
MOV   AL, 7
OUT   DX, AL
MOV   DX, 303H
MOV   AL, 1
OUT   DX, AL
```

- Control register is available via F0 index register. To read value from control register:

```
MOV   DX, 302H
MOV   AL, F0H
OUT   DX, AL
MOV   DX, 303H
IN    AL, DX     ; AL contains control register value
```

- Now LED can be switched on:

```
OR    AL, 8      ; set bit#3
OUT   DX, AL
```

…or switched off:

```
AND   AL, 247    ; clear bit#3
OUT   DX, AL
```

- To leave configuration mode:

```
MOV   DX, 302H
MOV   AL, 57H
OUT   DX, AL
MOV   AL, 46H
OUT   DX, AL
```

Moreover, red D7 LED is lit when a BIOS error is detected and Reset signal is generated.

2.3.16.2 D7 Green and D8 Green LEDs Control

D7 and D8 indicators are controlled via Super I/O LPC47M10X controller registers programming.

For control purposes, GPI42 line is programmed as output. Setting logical "1" at it lights up the LED, setting logical "0" switches it off.

3 Installation

CPC800-02 is easy to install. However, it is necessary to follow the procedures and safety regulations below to install the module correctly without damage to the hardware, or harm to personnel.

The installation of the peripheral drivers is described in the accompanying information files. For details on installation of an operating system, please refer to the relevant software documentation.

3.1 Safety Regulations

The following safety regulations must be observed when installing or operating the CPC800-02. Fastwel assumes no responsibility for any damage resulting from infringement of these rules.

Warning!

When handling or operating the module, special attention should be paid to the heatsink, because it can get very hot during operation. Do not touch the heatsink when installing or removing the module.

Moreover, the module should not be placed on any surface or in any kind of package until the module and its heatsink have cooled down to ambient temperature.

Caution!

Always switch off the system power before connecting or disconnecting the power supply cable to the module's power connector. Disregarding this requirement could be harmful for your life or health and can damage the module or entire system.

ESD Sensitive Equipment!

This product comprises electrostatically sensitive components. Please follow the ESD safety instructions to ensure module's operability and reliability:

- Use grounding equipment, if working at an anti-static workbench. Otherwise, discharge yourself and the tools in use before touching the sensitive equipment.
- Try to avoid touching contacts, leads and components.
- Disconnect power cable before mounting or removing PC/104 or PC/104-Plus expansion modules.

Extra caution should be taken in cold and dry weather.

3.2 CPC800-02 Installation Procedure

To install CPC800-02, follow the instructions below.

1. Keep to the safety regulations of the Section 3.1 when performing the following operations.

Warning!

Failure to accomplish the following instruction may damage the module or result in incorrect system operation.

2. Ensure that the module configuration corresponds to the application requirements before installing. For information regarding the configuration of the CPC800-02, refer to Chapter 4. For the installation of CPC800-02 specific peripheral devices, I/O devices and expansion modules refer to the appropriate sections in Chapter 3.
3. To install the CPC800-02 perform the following:
    1. Fasten the included stud spacers on the board. It is recommended to use eight spacers for mounting the CPC800-02. This ensures rigid fastening of the board, increases reliability and vibration stability.

       Verify that the washers and spacers do not touch any of the component pads adjoining to the mounting holes. This will lead to damage at power-up.
    2. Install the CPC800-02 on a panel and fasten the spacers on it.
       Please, refer to Figure 1-5 for mounting openings coordinates.

Warning!

Make sure the power supply is OFF when connecting the power cable to the CPC800-02 module. Damage to the module may occur if the power is ON when connecting the power cable.

Accidentally crossing the wires, i.e., plugging the voltage supply wires into the ground connector or vice versa will damage the CPC800-02 module.

    3. Connect all the required interface cables.
    4. Connect a power supply to the CPC800-02 processor module. Refer to the Power Supply Requirements in section 6.2. The power supply connector J1 is located at the top side of the module. Please, refer to Figure 1–3.

Note:

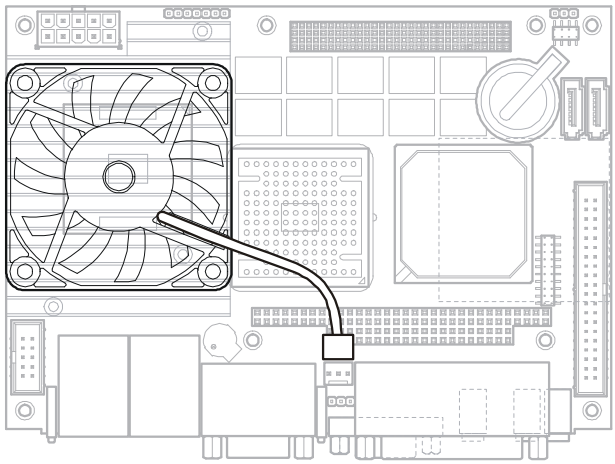
+12 V and –12 V voltages are supplied to PC/104-Plus connectors and are not required for CPC800-02 fanless operation.

4. CPC800-02 is now ready for operation. Please, refer to appropriate software, application, and system documentation to get further instructions.

3.3 Cooling Fan Installation

Cooling fan is installed on the processor heatsink using four screws and retaining toothed washers supplied with a fan.

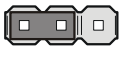
Figure 3-1: Fan Installation



To install the fan do the following:

1. Make sure that the system power is off before installing the fan and connecting its connector. Please, remember that the processor heatsink can be very hot after operation.
2. Select the required power voltage using the J21 fan voltage selector:

Off



Contacts 1-2 closed,
+12 V is supplied to the pin "2" of the fan connector.

Contacts 2-3 closed,
+5 V is supplied to the pin "2" of the fan connector.

3. Orient the fan to provide convenient connection of its power cable. The airflow should be directed towards the processor heatsink. Install the fan on the processor heatsink and fasten the four screws. Use retaining toothed washers to fix the fan reliably.
4. Connect the fan power cable to the J15 onboard connector.
5. The processor cooling fan is now ready for operation.

3.4 Dismounting Procedures

To dismount the module do the following:

1. When performing the next actions, keep to safety regulations of the Section 3.1. Pay special attention to the temperature of the heatsink!
2. Ensure that the system power is switched off before proceeding.
3. Disconnect all interface cables that may be connected to the module.
4. Unscrew all the retaining screws. Do not touch the heatsink, since it can get very hot during operation.
8. Dispose of the module at your discretion. The module should not be placed on any surface or in any form of storage container until the board and the heatsink have cooled down to room temperature.

3.5 Installation of CPC800-02 Peripheral Devices

A lot of peripheral devices can be connected to the CPC800-02. Their installation procedures differ significantly. Therefore the following sections provide mainly general guidelines regarding installation of peripheral devices. The details on external devices connection can be found in documentation supplied with these devices.

3.5.1 USB Devices Connection

CPC800-02 can accept Plug&Play connection of USB 2.0 computer peripheral devices (printers, keyboards, mice, etc.) All USB devices may be connected or disconnected while the host power is on.

3.5.2 CompactFlash Cards Installation

CompactFlash socket of CPC800-02 supports any 3.3 V or 5 V CompactFlash ATA type I/II cards. Carefully slide the correctly oriented card in and gently press to engage the contacts completely.

Note:

Connection of the CompactFlash cards while the power is on may damage your system.

Note

It is recommended to use CompactFlash-cards, which has been initialized and formatted in this module.
By default, CPC800-02 utilizes LBA mode. Utilization of CompactFlash cards, which has been initialized and formatted in another mode, may lead to errors in operation of the module.

3.5.3 Battery Replacement

The lithium battery must be replaced with Panasonic BR2032 or a battery with similar characteristics.

The expected life of a 190 mAh battery (Panasonic BR2032) is about 5 years. However, this typical value may vary because battery life depends on the operating temperature and the shutdown time of the system in which the battery is installed.

Note...

It is recommended to replace the battery after approximately 4 years to be sure it is operational.

Note:

Replacing the battery, make sure the polarity is correct ("+" up).

Dispose of used batteries according to the local regulations.

3.5.4 PC/104 and PC/104-Plus Expansion Modules Installation

The PC/104 and PC/104-Plus connectors allow you to install interface expansion modules. They can be stacked to form a highly integrated control system. CPC800-02 is capable to communicate with up to four PC/104 or PC/104-Plus expansion modules.

Warning!

When installing any PC/104 or PC/104-Plus module, avoid excessively flexing the CPC800-02 board. Mate pins correctly and use the required mounting hardware.

Note...

Before installing and operating the PC/104-Plus expansion modules it is necessary to set the voltage supplied to PCI interface I/O buffers using the J3 VIO selector. See details in Section 4.1.

Note...

To allow an additional amount of distance between CPC800-02 heatsink and PC/104 expansion module connectors, it is recommended to use stackthrough intermediate connectors and additional standoffs. ISA (1375795-2, 1375795-4) and PCI (AMP 1375799-1, AMP 1375799-4) spacers are offered by Tyco/AMP.

PC/104 and PC/104-Plus Mounting Fasteners

1. Brass hex standoff spacer, PCHSN-15 – 8 items
2. Plain washer 3, DIN 125Z – 4 items
3. Toothed washer M3, DIN 6798A – 4 items
4. Nut M3, DIN 934Z – 4 items
5. Screw M3x8, DIN7985 – 4 items

4 Configuration

4.1 Power Supply Unit Type Selection

A standard 2-pin jumper switch (J30) for selection of an external power supply type is installed on the top side of the module. Figure 4-1 below explains J30 jumper positions.

Figure 4-1: J30 Power Supply Type Selector Positions

If an external power supply does not support control functions, contacts 1-2 should be closed.

Open position of the jumper (default) corresponds to an ATX external power supply with control functions support.

Note:

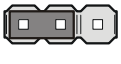
If an external power supply without control functions support is used, it is allowed to leave contact 6 of J1 power connector not connected.

4.2 PC/104-Plus Voltage Selection

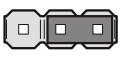
The PC/104-Plus voltage should be set before installation of PC/104-Plus expansion modules.

Figure 4-2: PC/104-Plus VIO Selector J3 Positions

There is a standard 3-pin header for PC/104-Plus voltage selection. The explanation of its jumper positions is presented below.



Contacts 1-2 closed, +5 V power is supplied to PCI interface I/O buffers



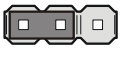
Contacts 2-3 closed, +3.3 V

4.3 Fan Voltage Selection

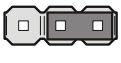
J21 3-pin jumper switch located next to the fan connector on board allows to select the cooling fan voltage. The options are: "+5 V", "+12 V", "Off". The three positions of a jumper are illustrated below.

Figure 4-3: Fan Voltage Selector J21 Positions

Off



Contacts 1-2 closed,
+12 V is supplied to the pin "2" of the fan connector.

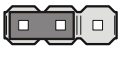


Contacts 2-3 closed,
+5 V is supplied to the pin "2" of the fan connector.

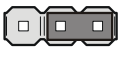
4.4 TFT Panel Power Voltage Selection

J25 is a standard 3-pin header used for TFT power voltage (V_{DD}) selection. It is located on the top side of the module. Figure below presents explanation of its jumper positions.

Figure 4-4: J25 TFT Panel Power Voltage Selector



Pins 1-2 closed: +5 V power is supplied to a panel



Contacts 2-3 closed: +12 V is supplied

Attention!

Take due care selecting TFT panel power voltage!

Wrong setting can result in a damage to the panel. Please, apply to specifications of a panel for correct voltage level.

4.5 Interrupts Handling

Interrupt handling of the CPC800-02 module corresponds to the standard AT IRQ mapping (8259 IRQ controller integrated in the chipset). The functions of the interrupts described below are the default ones, but can be modified via the BIOS Setup.

Table 4-1: Interrupt Settings

IRQ	Priority	Standard Function
IRQ0	1	System Timer
IRQ1	2	Keyboard Controller
IRQ2	–	Input of the second IRQ controller (IRQ8-IRQ15)
IRQ3	11	COM2
IRQ4	12	COM1, COM3
IRQ5	13	Reserved
IRQ6	14	– *
IRQ7	15	LPT
IRQ8	3	System Real Time Clock
IRQ9	4	PCI or ACPI *
IRQ10	5	PCI or COM ports *
IRQ11	6	PCI *
IRQ12	7	PCI or PS/2 mouse
IRQ13	8	Coprocessor error
IRQ14	9	Primary IDE channel
IRQ15	10	Secondary IDE channel*
NMI	–	Reserved

** – assigned in BIOS Setup*

4.6 On-board PCI Interrupts

The ICH handles up to 8 PCI interrupt inputs. The table below describes the connected to these PIRQs PCI devices and their functions.

Table 4-2: PCI Interrupt Routing

ICH IRQ Input	PCI Device	Internal ICH Function
PIRQA	PC104-Plus IRQA	USB 1.0 controller #1
PIRQB	PC104-Plus IRQB	AC97 + MODEM + SMBUS
PIRQC	PC104-Plus IRQC	Storage (IDE/SATA) native mode
PIRQD	PC104-Plus IRQD	USB 1.0 controller #2
PIRQE	Gigabit Ethernet	Free
PIRQF	Free	Free
PIRQG	Free	Free
PIRQH	Security	USB 2.0 controller

The details can be found in the ICH technical documentation.

4.7 Memory Maps

The CPC800-02 module employs the standard AT ISA memory mapping. The details of memory mapping are presented in the following subsections.

4.7.1 First Megabyte Memory Map

The following table shows the memory map for the first megabyte:

Table 4-3: First Megabyte Memory Map

Memory Address Range	Size	Function
0xE0000 – 0xFFFFF	128 k	BIOS implemented in FWH Reset vector 0xFFFF0
0xD0000 – 0xDFFFF	64 k	Free
0xCC000 – 0xCFFFF	16 k	Free
0xC0000 – 0xCC800	48 k	VGA card BIOS
0xA0000 – 0xBFFFF	128 k	Normally used as video RAM according to: CGA: 0xB8000-0xBFFFF Monochrome: 0xB0000-0xB7FFF EGA/VGA: 0xA0000-0xAFFFF
0x00000 – 0x9FFFF	640 k	DOS memory space

4.7.2 I/O Addresses

The following table presents the I/O memory mapping:

Table 4-4: I/O Address Map

Address	Device
000,00F	DMA controller #1
020,02D	Interrupt controller #1
040,043	Timer
060,064	Keyboard interface
070,077	RTC port
080,09F	DMA page register
0A0,0BD	Interrupt controller #2
0C0,0DF	DMA controller #2
0F0,0FF	Math coprocessor
170,17F	Hard disk, secondary
1F0,1FF	Hard disk, primary
2E8,2EF	Serial port COM4
2F8,2FF	Serial port COM2
376	SATA channel #1
3F6	SATA channel #2
378,37F	Parallel printer port LPT1
3E8,3EF	Serial port COM3
3F8,3FF	Serial port COM1

5 Phoenix® BIOS Setup

The Phoenix® BIOS in your SBC is an adapted version of a standard BIOS for IBM PC AT-compatible personal computers equipped with Intel®x86 and compatible processors. The BIOS provides low-level support for the central processing, memory, and I/O system units.

With the help of BIOS Setup program, you can modify BIOS configuration parameters and control special features of your module. The Setup program is launched by pressing the F2 key and offers a convenient menu interface to modify basic system configuration settings and switching between the subsystems operation modes. These settings are stored in a dedicated battery-backed memory, CMOS RAM, that keeps the information when the power is switched off.

5.1 Boot Details

5.1.1 Booting without a Monitor, Keyboard or Mouse

To boot without a monitor, keyboard or mouse set the item "POST Errors" to "Disabled" at the page "Main" in PhoenixBIOS Setup program. This setting is a default one.

Note!

If the module was booted without a connected monitor, the display will be empty, even if a monitor is connected later during operation. To get the correct display output it is necessary to reboot the module with a connected monitor. This is a Intel VideoBIOS particularity.

5.1.2 Booting from USB

To boot from a device connected to USB:

- Connect the device to boot from to a USB port. The appropriate USB controller should be enabled;
- Enter the PhoenixBIOS Setup program;
- Find this USB device at the "Boot" page and use «+» «–» buttons to move it in order to change its boot priority;
- Save changes and reboot the module.

To get the on-line help about the details of BIOS Setup program operation, please apply to the screen tips and the integrated help system.

6 Thermal and Power Issues

6.1 Temperature Control

Intensive operation of Intel Pentium M processor in harsh environment requires a special technology to keep the processor's die temperature within allowed limits. The following sections provide system integrators with the information, which will help to meet thermal requirements when developing systems based on CPC800-02.

6.1.1 Passive Regulation

The thermal management concept of CPC800-02 module includes four separate but correlated functions. Their main purpose is to protect the processor from overheating and reduce its power consumption. Dedicated thermal control subsystem allows the processor to operate within safe temperature range without the need for special software or interrupt handling.

The four thermal protection functions provided by the processor are:

1. **Thermal Throttling**: Pentium M internal thermal monitor controls the temperature of the processor. The internal temperature sensor is located near the hottest area of the processor die. Each processor is individually adjusted at the factory to compensate the potential manufacturing variations of its characteristics. To reduce the processor power dissipation the internal thermal monitor alternatively switches the processor core clock on and off with a duty cycle factor of 50% (cycle times are processor speed dependent) or initiates an Enhanced Intel SpeedStep® technology transition.
2. The Intel® Pentium® M processor supports the Intel **SpeedStep**® enhanced technology. Built-in processor logic together with a software utility allow to switch the processor between multiple frequency and voltage operating points without resetting the system. For example, the processor operating at 1.6 GHz and 1.484 V (HFM) can be switched down to 600 MHz and 0.956 V (LFM), thus reducing the processor power consumption in approx. 4 times.
3. **Thermtrip** function is always on to protect the processor in any event. In case of a serious cooling subsystem failure, the processor will automatically shut down when the die temperature has reached approximately 125°C. Once Thermtrip is activated, the system does not return to the normal operation mode automatically, it is necessary to reset the BIOS settings and to cold restart the system. The BIOS settings can be reset by lifting the contact plate of the battery holder for a period of more than 5 seconds.
4. **External thermal monitor** (LM87) gathers information about the processor and board surface temperatures from two sensors. This information may then be requested by a program to undertake the appropriate actions.

Recommendations

Generally, there is no need to enable the Thermal Management functions if the module is operated in a optimally designed environment with sufficient air flow. However, to guarantee a stable system in unsteady industrial environment, both the internal and the external thermal monitors should be enabled. These two monitors protect the processor and the whole system against overheating.

Note:

Thermal Management functions should be disabled when performing Benchmarks and performance tests, otherwise the results will be incorrect due to the power reduction processes influence.

6.1.2 Active Regulation

To provide controlled active heat dissipation CPC800-02 is equipped with specially designed heatsinks. One is mounted on the North bridge chip, another one – on the processor. The processor heatsink is provided with a cooling fan. Installation of a cooling fan allows to keep the processor temperature within the prescribed limits and to maintain higher processor operating frequency, especially for processor performance demanding applications in harsh industrial environments.

The cooling fan together with everything needed for its installation is supplied with the CPC800-02. The fan installation instructions can be found in section 3.3 in this Manual.

When developing applications using the CPC800-02, the system integrator must take into account the overall system thermal requirements. System chassis must satisfy these requirements. When performing thermal calculations for certain application, the developer must consider the contribution of peripherals to be used with the CPC800-02 to the total heat emission. These devices must also be capable to operate at the temperatures within the system operating range, especially those, which are installed directly on the CPC800-02 processor module.

Warning!!!

Since Fastwel assumes no responsibility for any damage to the CPC800-02 or other equipment resulting from overheating of the CPU, it is highly recommended that system integrators as well as end users confirm that the operational environment of the CPC800-02 complies with the thermal considerations stated in this document.

6.2 System Power

The new Intel Pentium M processor family requires special characteristics of the power supply. The CPC800-02 module itself has been designed to provide best possible power supply for each system unit. However, in order to guarantee reliable and faultless operation the following requirements must be taken into account. Absolute maximum input voltages presented in the table below must not be exceeded to guarantee that the CPC800-02 is not damaged. The ranges for the different input power voltages, within which the module is functional, are also presented.

Table 6-1: DC Input Voltage Ranges and Limits

Power Voltage, V	Maximum Permitted Value, V	Absolute Limits, V	Recommended Range, V
+3.3	+3.6	3.14 to 3.47	3.3 to 3.47
+5	+5.5	4.75 to 5.25	5.0 to 5.25
+5B_SBY	+5.5	4.75 to 5.25	5.0 to 5.25
+12	+14.0	11.4 to 12.6	–
-12	-14.0	-11.4 to -12.6	–

Input power connections should provide minimum power loss. Avoid using long input lines, low carrying capacity cables, high resistance connections.

To select the appropriate system power supply, it is necessary to consider the CPC800-02 own power consumption (about 35 watts), the consumption of the other system components, possible variations of power consumption during operation (e.g. due to temperature changes) and some reserve. Taking all this into account, it is recommended to use a 150 watt power supply. If possible, power supplies with voltage sensing should be used.

Table 6-2: CPC800-02 Power Consumption

Processor	Min (600 MHz), watt	Max, watt
P1.1 – Pentium M 1.1 GHz LV 400 MHz FSB	17 W	24 W
P1.4 – Pentium M 1.4 GHz LV 400 MHz FSB	18 W	25 W
P1.8 – Pentium M 1.8 GHz 400 MHz FSB	18 W	39 W

Table 6-3: Some CPC800-02 Components Power Consumption

System Components	5 V Power	3.3 V Power
Keyboard	up to 500 mW	–
DDR SDRAM 1 GB PC2700	up to 14.85 W	
CompactFlash card	–	up to 990 mW

7 Appendices

7.1 Supplementary Information

7.1.1 Related Standards and Specifications

The Fastwel's EPIC boards comply with the requirements of the following standards:

Table 7-1: Related Standards

Type	Standard	Test Parameters
CE: Emission	EN50081-1	–
CE: Immission	EN61000-6-2	–
CE: Electrical safety	EN60950	–
Mechanical dimensions	IEEE 1101.10	–
Vibration (sinusoidal)	IEC60068-2-6-82; Fc	5g / 10-500 Hz / 10 (acceleration / frequency range / test cycles per axis)
Permanent shock	IEC60068-2-29-87; Eb	50g / 11 ms / 1000±10 / 1 s (peak acceleration / shock duration half sine / number of shocks / recovery time)
Single shock	IEC60068-2-27-87; Ea	100g / 9 ms / 18 / 3 s (peak acceleration / shock duration / number of shocks / recovery time in seconds)

Important...

Some versions of the module may have the test results differing from the ones presented in the above table. For more information please contact Fastwel's official representatives.

Information related to this product and its components can be found in the following specifications:

Table 7-2: Related Specifications

Product	Specification
EPIC Boards	EPIC Specification Revision 1.1 July 2004 http://www.epic-sbc.org
PC/104 and PC/104-Plus Interfaces	PC/104 Specification Revision 2.5, November 2003 PC/104-Plus Specification Revision 2, November 2003 For latest revision of the PC/104 specifications, contact the PC/104 Consortium, at: http://www.pc104.org
PCI Bus	PCI 2.2 Compliant Specifications For latest revision of the PCI specifications, contact the PCI Special Interest Group Office at: http://www.pcisig.com
CompactFlash Cards	CF+ and CompactFlash Specification Revision 4.1

7.2 Useful Abbreviations, Acronyms and Short-cuts

Abbreviation	Meaning
BMC	Baseboard Management Controller
PM	Peripheral Management Controller
IPMI	Intelligent Platform Management Interface
IPMB	Intelligent Platform Management Bus
I^2C™	Inter Integrated Circuit Two-thread serial protocol, used in SMB and IPMI
KCS interface	Keyboard Controller Style interface Interface for communication between control software and BMC, similar to a keyboard controller interface
BT interface	Block Transfer interface Block transfer interface for communication between control software and BMC
DDR SDRAM	Double Data Rate Synchronous Dynamic Random Access Memory
SODIMM	Small Outline Dual In-Line Memory Module
ECC	Error Correction Code Data error correction technology used in memory modules
FWH	Firmware Hub Nonvolatile memory chip, part of Intel chipset, used for BIOS storage in CPC800-02
GMCH	Graphics and Memory Controller Hub
DAC	Digital-Analog Converter
USB	Universal Serial Bus
LPC	Low Pin Count External devices communication interface
SMB	System Management Bus
UART	Universal Asynchronous Receiver-Transmitter
UHCI	Universal Host Controller Interface USB Host Controller Interface
EHCI	Enhanced Host Controller Interface (Universal Serial Bus specification)
UTP	Unshielded Twisted Pair
CRT-display	Cathode Ray Tube Display
PMC	PCI (Peripheral Component Interconnect) Mezzanine Card
CMC	Common Mezzanine Card
LVDS	Low Voltage Differential Signal Digital monitors communication specification
RTC	Real Time Clock
BIOS	Basic Input-Output System
PC	Personal Computer
PICMG	PCI Industrial Computer Manufacturers Group
AHA	Accelerated Hub Architecture GMCH and ICH communication bus specification
AGP	Accelerated Graphics Port

Abbreviation	Meaning
AGTL	Advanced Gunning Transceiver Logic PSB (Processor Side Bus) signal exchange specification
SMBus	System Management Bus
EEPROM	Electrically Erasable Programmable Read-Only Memory
NAND Flash	Not And (electronic logic gate) Flash memory specification
SSD	Solid State Disk
PLCC	Plastic Leaded Chip Carrier
RAMDAC	Random Access Memory Digital-to-Analog Converter
DAC	Digital-to-Analog Converter
DVMT	Dynamic Video Memory Technology
TTL	Transistor-Transistor Logic
ECP/EPP	Extended Capabilities Port / Enhanced Parallel Port Parallel port specifications
FDD	Floppy Disk Drive
EIDE	Enhanced Integrated Drive Electronics Mass storage devices interface
DMA	Direct Memory Access
PIO	Programmed Input/Output EIDE: Directly processor controlled data exchange
Rear I/O Board	Rear Input-Output Board Auxiliary interface board, which is connected to the cPCI backplane rear connectors
PWM output	Pulse-Width Modulation Cooling fan control technique
ESD	Electrostatically Sensitive Device Electrostatic Discharge
ACPI	Advanced Configuration and Power Interface
POST	Power On Self Test
EOS	Electrical Overstress
MDI	Media Dependent Interface Interface with connection type automatical detection
UHCI	Universal Host Controller Interface